CONTRACTORS' & ENGINEERS' MONTHLY

A Purchasing Guide for Engineers, Contractors, Public Officials and Other Purchasers of Construction Materials and Equipment.

Texaco Engineer Cooperating with Contractor on Asphalt Job

TEXACO engineers get "right down on the job." They help, assist, do real work.

That's the kind of service contractors and engineers want—so that's the kind The Texas Company gives.

Let the TEXACO Engineers assist you in your road work. It costs you nothing.

Write for our Texaco Asphalt literature and learn what real help to contractors and engineers means. Write today!

TEXACO

The Texas Company

ASPHALT SALES DEPT.

17 Battery Place, New York City

New York	Jacksonville	Chicago	Houston
Philadelphia	Atlanta	Cleveland	Omaha
Richmond	New Orleans	Oklahoma City	Minneapolis
Boston	Memphis	Kansas City	Wichita

TEXACO

JUNE 1921 — 25 Cents the Copy, One Dollar Yearly

The SEARCHLIGHT SECTION

of

ENGINEERING NEWS-RECORD

(Circulation 30,000 Weekly)

"Searchlight" prints the largest variety of good used contractors' equipment for sale, rent or exchange to be found anywhere. It is the NATIONAL exchange center for such plant and for every other business want of contractors. Each week brings a new list of plant and new opportunities of all kinds for business—contracts wanted and to-be-let, financial, employment, etc., etc.

The CONTRACTORS' GUIDE for

SECOND-HAND EQUIPMENT
For Sale — For Rent
Exchange — Wanted

CONTRACTS TO-BE-LET
Government, Municipal & Private

BUSINESS OPPORTUNITIES
Work Wanted, Financial, Sub-Contracts, etc.

EXPERIENCED MEN
Available and Wanted

A Sample Copy—FREE

Be sure you see the searchlight Section of Engineering News-Record regularly. Without obligation to you we would like to send you a copy of Engineering News-Record for your inspection. We want you to know how "Searchlight" is ready to serve you and how you can use it profitably.

Write at Once.

Searchlight Dept.—McGRAW-HILL CO., INC.—475 10th Ave., New York City

SEARCHLIGHT SECTIONS appear only in McGRAW-HILL publications—each the leader in its field.

Engineering and Mining Journal
Electric Railway Journal
Electric Merchandising
Journal of Electricity & Western Industry
Coal Age
Engineering News-Record
Chemical & Metallurgical Engineering
Power
American Machinist
Electric World
Ingeneria Internacional

ACET
Li
Pr

ACET
Ox

ADDI

AIR
*Al
*De
*Fi
*Ge
*In
*No
*St
Ce
Cl
De
Ga
He
In
No
Sc
St
Su
Un
W
W

ARC
*Ge
*W

ARCH
Ch
Di
Hi
Sn
Ste

ARMO
*Tr
Co

ARTE
*Ar

ASBE
*Ca
Do
Ke

ASH
*Ot
Ba
Br
By
Ch
Gi
Gr
Gu
Ha
Je
Ki
La
Li
Po
Ro
We

Where to Purchase

A comprehensive Directory of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may desire to secure catalogs or prices on construction equipment. Where the name of a manufacturer is preceded by a star (*) it indicates that the user of the directory may secure further information by referring to the manufacturer's advertisement in this issue. The index to advertisers will be found on page facing the inside back cover.

ACETYLENE
Linde Air Products Co., New York.
Prest-O-Lite Co., Inc., New York.

ACETYLENE APPARATUS
Oxweld Acetylene Co., Newark, N. J.

ADDING MACHINES. (See Calculating Machines.)

AIR COMPRESSORS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*De Laval Steam Turbine Co., Trenton, N. J.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Indiana Air Pump Co., Indianapolis, Ind.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Standard Scale & Supply Co., Pittsburgh, Pa.
Cement-Gun Co., Inc., Cornwell Hts., Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
De La Vergne Machine Co., N. Y. C.
Gardner Governor Co., Quincy, Ill.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., N. Y. C.
Norwalk Iron Works Co., South Norwalk, Conn.
Schramm & Son, Inc., Chris. D., Philadelphia, Pa.
Stratton & Bragg Co., Petersburg, Va.
Sullivan Mchy. Co., Chicago, Ill.
United Iron Works, Kansas City, Mo.
Westinghouse Trac. Brake Co., Wilmerding, Pa.
Worthington Pump & Mchy. Corp., N. Y. C.

ARC LAMPS
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ARCHITECTURAL IRON WORK
Chesapeake Iron Works, Baltimore, Md.
Dietrich Bros., Baltimore, Md.
Hirsch Rolling Mill Co., St. Louis, Mo.
Snead Arch Iron Works, Louisville, Ky.
Stewart Iron Works Co., Cincinnati, Ohio

ARMORED CONCRETE PAVEMENTS
*Truscon Steel Co., Youngstown, Ohio.
Concrete Steel Co., New York.

ARTESIAN WELL DRILLS AND PUMPS
*Am. Well Works, Aurora, Ill.

ASBESTOS, ETC.
*Carey Co., Philip, Cincinnati, Ohio.
Dominion Asbestos & Rubber Corp., N. Y. C.
Keasbey & Mattison Co., Ambler, Pa.

ASH HANDLING MACHINERY
*Otterson Auto Eductor Co., Springfield, O.
Bartlett & Snow Co., C. O., Cleveland O.
Brown Hoisting Mach. Co., Cleveland, Ohio.
Byers Mach. Co., J. F., Ravenna, Ohio.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Green Eng. Co., East Chicago, Ind.
Guarantee Constr. Co., N. Y. C.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, Ohio.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Eng. Co., Cleveland, O.
Link Belt Co., Chicago, Ill.
Portable Mchy. Co., Passaic, N. J.
Robins Conv. Belt Co., N. Y. C.
Webster Mfg. Co., Chicago, Ill.

ASPHALT
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Standard Oil Co. of Ind., Chicago, Ill.
*Texas Co., N. Y. C.
*Warren Bros. Co., Boston, Mass.
Atlantic Refining Co., Philadelphia, Pa.
Gulf Refining Co., Pittsburgh, Pa.
Headley Good Roads Co., Philadelphia, Pa.
Sinclair Ref. Co., Chicago, Ill.
Standard Oil Co. of N. Y., N. Y. C.
Standard Oil Co. of N. J., Newark, N. J.
U. S. Asphalt Refining Co., N. Y. C.

ASPHALT KETTLES. (See Kettles for Asphalt and Tar Heating.)

ASPHALT PLANTS, TOOLS, ETC.
*Austin Machinery Corp'n., Chicago, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Warren Bros. Co., Boston, Mass.
Conklin & Harrington, Inc., New York, N. Y.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, Ohio.
Hetherington & Berner, Indianapolis, Ind.

ASPHALT ROLLERS. (See Road and Paving Rollers.)

ASPHALT SURFACE HEATERS
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Equitable Asphalt Maint. Co., Kansas City, Mo.
*Hauck Mfg. Co., Brooklyn, N. Y.

BACKFILLERS
*Austin Machinery Corp'n, Chicago, Ill.
*Koehring Machine Co., Milwaukee, Wis.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Cement Mchy. Co., Inc., Keokuk, Ia.
Constr. Mchy. Co., Waterloo, Ia.
Oshkosh Mfg. Co., Oshkosh, Wis.
Parsons Co., Newton, Ia.

BAR BENDERS AND CUTTERS
*Koehring Machine Co., Milwaukee, Wis.
*Ransome Concrete Machinery Co., Dunellen, N. J.
Concrete Steel Co., New York.
Electric Welding Co., Pittsburgh, Pa.
Hinman & Co., D. A., Sandwich, Ill.

BAR CHAIRS, REINFORCING
*Truscon Steel Co., Youngstown, Ohio.
Concrete Steel Co., N. Y. C.
Universal Form Clamp Co., Chicago, Ill.

BARS, IRON AND STEEL
Aborn Steel Co., Inc., N. Y. C.
Bethlehem Steel Co., So. Bethlehem, Pa.
Carbon Steel Co., Pittsburgh, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Franklin Steel Works, Franklin, Pa.
Gulf States Steel Co., Birmingham, Ala.
Hirsch Rolling Mill Co., St. Louis, Mo.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
Midvale Steel & Ordnance Co., Philadelphia, Pa.
Republic Iron & Steel Co., Youngstown, O.
St. Louis Screw Co., St. Louis, Mo.
Sweet's Steel Co., Williamsport, Pa.

** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

DRAINAGE CULVERTS *that* ENDURE *are* ESSENTIAL

NEWPORT CORRUGATED METAL CULVERTS

Are made of pure ingot iron which by actual laboratory tests has been shown to be the most rust-resisting for this purpose. Newport culverts are made in round and half-round forms to cover all conditions for which culverts may be used.

The proper drainage of the territory on the high side of a road makes it necessary that water be readily removed by a culvert that is permanent, not one which rusts or may be cracked by the first heavy load passing over the road. Newport Culverts resist the load, do not rust and serve faithfully year after year with no maintenance costs.

Send for our literature describing the special features of Newport Culverts.

NEWPORT CULVERT CO.

NEWPORT 542 West 10th Street **KENTUCKY**

BELTING, RUBBER
Allen Mfg. Co., W. D., Chicago, Ill.
Fairbanks Co., The, N. Y. C.
Goodall Rubber Co., Inc., Philadelphia, Pa.
Goodyear Tire & Rubber Co., Akron, O.
McMaster-Carr Supply Co., Chicago, Ill.
Mulconroy Co., Inc., Philadelphia, Pa.
Pa. Rubber Co., Jeanette, Pa.
Republic Rubber Co., Youngstown, Ohio.
Salisbury & Co., Inc., W. H., Chicago, Ill.
Southern Rubber & Belt. Co., Houston, Tex.
Union Asbestos & Rubber Co., Chicago, Ill.
Voorhees Rubber Mfg. Co., Jersey City, N. J.

BENDING MACHINES (PIPE)
Amer. Pipe Bending Mach. Co., Boston, Mass.
Hinman Co., D. A., Sandwich, Ill.
Walworth Mfg. Co., Boston, Mass.

BINS, STORAGE
*Fairfield Engineering Co., Lancaster, Ohio.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
*Ransome Concrete Machy. Co., Dunellen, N. J.
Atlas Eng. Co., Milwaukee, Wis.
Berger Mfg. Co., Canton, Ohio.
Galion Iron Works & Mfg. Co., Galion, Ohio.
Green Engineering Co., E. Chicago, Ind.
Petroleum Iron Works Co., Sharon, Pa.

BLAST HOLE DRILLING MACHINES. (See "Well Drilling and Blast Hole Machines")

BLASTING POWDER (See Explosives)

BLOCKS AND TACKLE
Boston & Lockport Block Co., East Boston, Mass.
Broderick & Bascom Rope Co., St. Louis, Mo.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Topping Bros., N. Y. C.
Upson-Walton Co., Cleveland, Ohio.

BLOWERS, PRESSURE
*De Laval Steam Turbine Co., Trenton, N. J.
*General Electric Co., Schenectady, N. Y.
American Blower Co., Detroit, Mich.
American Gas Furnace Co., N. Y. C.
Spencer Turbine Co., Hartford, Conn.

BLUE PRINT MACHINES
Indianapolis Blue Print & S'ply Co., Ind'apolis.
Wickes Bros., Saginaw, Mich.

BLUE PRINT PAPERS
Indianapolis Blue Print & S'ply Co., Ind'apolis.
Kolesch & Co., New York.

BOILERS
Abendroth & Root Mfg. Co., Newburgh, N. Y.
Ames Iron Works, Oswego, N. Y.
Babcock & Wilcox Co., N. Y. C.
Biggs Boiler Wks., Akron, Ohio.
Cameron & Barkley Co., Charleston, S. C.
Casey-Hedges Co., Chattanooga, Tenn.
Chandler & Taylor Co., Indianapolis, Ind.
Chatts. Boiler & Tank Co., Chattanooga, Tenn.
Cole Mfg. Co., R. D., Newnan, Ga.
Erie City Iron Works, Erie, Pa.
Flory Mfg. Co., S., Bangor, Pa.
Hartley Boiler Works, Montgomery, Ala.
Heine Safety Boiler Co., St. Louis, Mo.
Houston, Stanwood & Gamble Co., Cincinnati, O.
Industrial Works, Bay City, Mich.
Ladd Co., Geo. T., Pittsburgh, Pa.
Leffel & Co., J., Springfield, O.
Lombard Iron Works, Augusta, Ga.
Lord & Burnham Co., Irvington, N. Y.
Murray Iron Works Co., Burlington, Ia.
New Bern Iron Wks. & Sup. Co., New Bern, N. C.
Petroleum Iron Works Co., Sharon, Pa.
Randle Mchy. Co., Cincinnati, O.
Schofield Iron Works, Macon, Ga.
Traylor Engr. & Mfg. Co., Allentown, Pa.
Valk & Murdoch Co., Charleston, S. C.
Vogt Mchy. Co., Inc., Louisville, Ky.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

BOLTS, NUTS, NAILS, RIVETS, SPIKES
American Screw Co., Providence, R. I.
American Spike Co., N. Y. C.
Ames, W. & Co., Jersey City, N. J.
Beck & Corbitt Iron Co., St. Louis, Mo.
Bethlehem Steel Co., Bethlehem, Pa.
Camden Forge Co., Camden, N. J.
Clark Bros. Bolt Co., Millidale, Conn.
Grant, Robt., N. Y. C.
Hoffman & Co., R. C., Inc., Baltimore, Md.
Inland Steel Co., Chicago, Ill.
Larkin, J. K., N. Y. C.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Rhode Island Tool Co., Providence, R. I.
Russell, Bursdall & Ward Co., Port Chester, N. Y.
Ryerson & Son, J. T., Chicago, Ill.
St. Louis Screw Co., St. Louis, Mo.
Star Exp. Bolt Co., N. Y. C.
Topping Bros., N. Y. C.
Sweet's Steel Co., Williamsport, Pa.

BRACES, TRENCH
*Duff Mfg. Co., Pittsburgh, Pa.
*Waldo Bros. & Bond Co., Boston, Mass.
Clow & Sons, J. B., Chicago, Ill.

BRASS GOODS
*Hays Mfg. Co., Erie, Pa.
*Mueller Mfg. Co., H., Decatur, Ill.
*Union Water Meter Co., Worcester, Mass.
Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.
United Brass Mfg. Co., Cleveland, O.

BRICK, PAVING (See Paving Brick)

BRIDGES AND BUILDINGS, STEEL
*Chicago Bridge & Iron Works, Chicago, Ill.
*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
American Bridge Co., N. Y. C.
Bellefontaine Bridge & Steel Co., Bellefontaine, O.
Belmont Iron Works, Philadelphia, Pa.
Berlin Constr. Co., Berlin, Conn.
Bethlehem Steel Bridge Corp., Bethlehem, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Boston Bridge Works, Boston, Mass.
Central States Bridge Co., Indianapolis, Ind.
Champion Bridge Co., Wilmington, O.
Chesapeake Iron Works, Baltimore, Md.
Eastern Bridge & Struc. Co., Worcester, Mass.
Ferguson Co., H. K., Cleveland, O.
Flour City Orn. Iron Co., Minneapolis, Minn.
Fort Pitt Bridge Works, Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.
Ingalls Iron Works Co., Birmingham, Ala.
Inland Steel Co., Chicago, Ill.
Inter. Steel & Iron Co., Evansville, Ind.
King Bridge Co., Cleveland, O.
Lackawanna Bridge Co., Buffalo, N. Y.
Lewis-Hall Iron Wks., Detroit, Mich.
Louisville Bridge & Iron Co., Louisville, Ky.
McClintic Marshall Co., Pittsburgh, Pa.
Milwaukee Bridge Co., Milwaukee, Wis.
Minn. Steel & Mchy. Co., Minneapolis, Minn.
Missouri Vy. Bdge. & Iron Co., Leavenworth, Kan
Morava Constr. Co., Chicago, Ill.
Mt. Vernon Bridge Co., Mt. Vernon, Ohio.
Penn. Bridge Co., Beaver Falls, Pa.
Richmond Struc. Steel Co., Richmond, Va.
Riverside Bridge Co., Martins Ferry, O.
Toledo Crane Co., Toledo, O.
Virginia Bridge & Iron Co., Roanoke, Va.
Wisc. Bridge & Iron Co., North Milwaukee, Wis

BUCKETS, AUTOMATIC DUMPING
*Littleford Bros., Cincinnati, O.
Lakewood Engineering Co., Cleveland, O.
Stuebner Iron Works, G. L., Long Island City, N. Y.

BUCKETS, CLAM SHELL
*Austin Mach. Corp., Chicago, Ill.
*Owen Bucket Co., Cleveland, O.
Advance Eng. Co., Cleveland, O.
Blaw-Knox Co., Pittsburgh, Pa.
Brosius, E. E., Pittsburgh, Pa.
Brown Hoisting Mchy. Co., Cleveland, O.
Browning Co., Cleveland, O.
Byers Mach. Co., J. F., Ravenna, O.
Haiss Mfg. Co., Geo., N. Y. C.
Hayward Co., N. Y. C.
Industrial Works, Bay City, Mich.
Kiesler Co., J. F., Chicago, Ill.
Lakewood Engineering Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Williams Co., G. H., Erie, Pa.

BUCKETS, CONCRETE
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Rochester Can Co., Rochester, N. Y.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.
Smith Co., T. L., Milwaukee, Wis.
Union Iron Works, Inc., Hoboken, N. J.

OWEN Clam Shell BUCKETS INSURE A BIGGER DAYS WORK
The Speed Bucket
for economical handling of crushed stone and other building materials from cars. The Type "O" Owen Bucket takes off the top of the load in less trips and cleans up the bottom in "jig" time.
THE ONLY BUCKET WITH LUBRICATED AND GRIT-PROOF MAIN BEARINGS. This and other features are big repair savers. Get complete data today.
The Owen Bucket Co.
418 Kirby Bldg., Cleveland, O.
OWEN

KEYSTONE ALL-STEEL MIXERS

Quality and quantity production feature these machines. They mix better concrete and mix it quicker.

Write for Bulletin No. 10 C-E.

POWER LOADER
10 Cubic Feet

LOW CHARGING
10 Cubic Feet

HALF BAG
6 Cubic Feet

KEYSTONE CONCRETE HANDLING CARTS

Patented

GRAY IRON FOUNDRY CO.
Est'd 1903
READING, PA.

HAUCK Oil Burning Contractors' Equipment

QUICK EFFICIENT ECONOMICAL

Burn Kerosene, Fuel, Crude Oils, and Distillate

HAUCK PRODUCTS INCLUDE

LEAD MELTING FURNACES, ASPHALT SURFACE HEATERS, KETTLE HEATERS FOR TAR ASPHALT AND PITCH.
LIGHTS, KEROSENE TORCHES ALL SIZES FOR GENERAL HEATING AND REPAIR WORK.
FORGES FOR RIVET HEATING
CONCRETE HEATERS (FOR WINTER WORK).
THAWERS (FOR WINTER WORK).

Write for Special Bulletin

HAUCK MANUFACTURING CO.
132 Tenth St. Brooklyn, N. Y.

LEADING CONTRACTORS HAVE BEEN USING HAUCK EQUIPMENT THE PAST FIFTEEN YEARS

BUCKETS, DRAGLINE
*Austin Mach. Corp., Chicago, Ill.
*Bucyrus Co., So. Milwaukee, Wis.
Brown Hoisting Mach. Co., Cleveland, O.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., N. Y. C.
Industrial Works, Bay City, Mich.
Monighan Machine Co., Chicago, Ill.
Sauerman Bros., Chicago, Ill.

BUCKETS, DREDGING AND EXCAVATING
*Austin Mach. Corp., Chicago, Ill.
*Bucyrus Co., So. Milwaukee, Wis.
*Owen Bucket Co., Cleveland, O.
Blaw-Knox Co., Pittsburgh, Pa.
Brown Hoisting Mach. Co., Cleveland, O.
Browning Co., Cleveland, O.
Hayward Co., N. Y. C.
Insley Mfg. Co., Indianapolis, Ind.
Kiesler Co., J. F., Chicago, Ill.
Lakewood Eng. Co., Cleveland, O.
Mead-Morrison Mfg. Co., East Boston, Mass.
Monighan Machine Co., Chicago, Ill.
Union Iron Works, Inc., Hoboken, N. J.
Williams Co., G. H., Erie, Pa.

BUCKETS, ORANGE PEEL
Haiss Mfg. Co., Geo., N. Y. C.
Hayward Co., New York.
Industrial Works, Bay City, Mich.
Kiesler Co., J. F., Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Mead-Morrison Mfg. Co., East Boston, Mass.
Orton & Steinbrenner Co., Chicago, Ill.
Vulcan Iron Works, Jersey City, N. J.

BUILDINGS, STEEL (See Bridges and Buildings)

BUNKS AND COTS
Fort Pitt Bedding Co., Pittsburgh, Pa.
Haggard & Marcusson Co., Chicago, Ill.
Southern Rome Co., Baltimore, Md.

CABLES (See Wire and Cables)

CABLEWAYS
Broderick & Bascom Rope Co., St. Louis, Mo.
Flory Mfg. Co., S., Bangor, Pa.
Lidgerwood Manufacturing Co., New York.
Roebling Sons Co., J. A., Trenton, N. J.
Sauerman Bros., Chicago, Ill.
Waterbury Co., N. Y. C.

CAISSONS
American Bridge Co., N. Y. C.
Foundation Co., N. Y. C.
Lackawanna Steel Co., Buffalo, N. Y.
O'Rourke Eng. Constr. Co., N. Y. C.
Petroleum Iron Works Co., Sharon, Pa.

CALCULATING MACHINES
*Monroe Calculating Machine Co., Orange, N. J.
Marchant Calc. Machine Co., Oakland, Cal.

CARS, INDUSTRIAL V. DUMPING
*Austin Mach. Corp., Chicago, Ill.
*Koppel Ind. Car & Eq. Co., Koppel, Pa.
Atlas Car & Mfg. Co., Cleveland, O.
Chase Fdry. & Mfg. Co., Columbus, O.
Easton Car & Constr. Co., N. Y. C.
Insley Mfg. Co., Indianapolis, Ind.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Oliver Mfg. Co., W. J., Knoxville, Tenn.
Stuebner Iron Works, G. L., Long Island City, N. Y.
United Iron Works, Kansas City, Mo.
Whiting Corp'n, Harvey, Ill.

CARTS, CONCRETE
*Gray Iron Fdry. Co., Reading, Pa.
*Littleford Bros., Cincinnati, O.
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Standard Scale & Supply Co., Pittsburgh, Pa.
Etnyre & Co., E. D., Oregon, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.
Smith Co., T. L., Milwaukee, Wis.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Toledo Wheelbarrow Co., Toledo, Ohio.

CAST IRON PIPE (See Pipe, Cast Iron)

CASTINGS, IRON AND STEEL
*American Cast Iron Pipe Co., Birmingham, Ala.
*Central Fdry. Co., N. Y. C.
*Gray Iron Fdry. Co., Reading, Pa.
*Lynchburg Fdry. Co., Lynchburg, Va.
*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
*Warren Fdry. & Mach. Co., N. Y. C.
Camden Iron Works, Camden, N. J.
Canton Fdry. & Mach. Co., Canton, Ohio.
Clark Co., H. W., Mattoon, Ill.
Flower Valve Mfg. Co., Detroit, Mich.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Jeffrey Mfg. Co., Columbus, O.
Marion Malleable Iron Works, Marion, Ind.
Pechstein Iron Works, Keokuk, Iowa.
Sessions Fdry. Co., Bristol, Conn.
Speidel, J. G., Reading, Pa.

CASTINGS, STREET AND SEWER
*Central Fdry. Co., N. Y. C.
*Dee Co., W. E., Chicago, Ill.
*Lynchburg Fdry. Co., Lynchburg, Va.
*U. S. Cast Iron Pipe & Fdry Co., Burlington, N. J.
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, J. B., Chicago, Ill.
Pechstein Iron Works, Keokuk, Ia.

CATCH BASINS AND MANHOLE COVERS
*Dee Co., W. E., Chicago, Ill.
*Thompson-Fleming Co., Inc., Buffalo, N. Y.
*U. S. Cast Iron Pipe & Fdry Co., Burlington, N. J.
Canton Fdry. & Mach. Co., Canton, Ohio.
Casey-Hedges Co., Chattanooga, Tenn.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Madison Fdry Co., Cleveland, O.
Pechstein Iron Works, Keokuk, Iowa.
Sessions Fdry. Co., Bristol, Conn.

CATCH BASIN CLEANING APPARATUS
*Otterson Auto Eductor Co., Springfield, O.

CAULKING MACHINERY
*Mueller Mfg. Co., H. Decatur, Ill.
*Smith Mfg. Co., A. P., East Orange, N. J.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., N. Y. C.

CAULKING MATERIALS
*Leadite Co, Philadelphia, Pa.
*United Lead Company, New York.

CEMENT
*Alpha Portland Cement Co., Easton, Pa.
Ash Grove Lime & Portland Cement Co., Kansas City, Mo.
Atlas Portland Cement Co., New York.
Canada Cement Co., Ltd., Montreal, Can.
Clinchfield Port. Cem. Corp., Kingsport, Tenn.
Crescent Portland Cement Co., Wampum, Pa.
Dewey Portland Cement Co., Kansas City, Mo.
Dixie Portland Cement Co., Chattanooga, Tenn.
Lehigh Portland Cement Co., Allentown, Pa.
Marquette Cement Mfg. Co., Chicago, Ill.
Penna. Cement Co., New York.
Riverside Portland Cement Co., Los Angeles, Cal.
Sandusky Cement Co., Cleveland, Ohio.
Texas Portland Cement Co., Dallas, Tex.
Universal Portland Cement Co., Chicago, Ill.
Wabash Portland Cement Co., Detroit, Mich.

CEMENT INSPECTION (See Inspecting Laboratories)

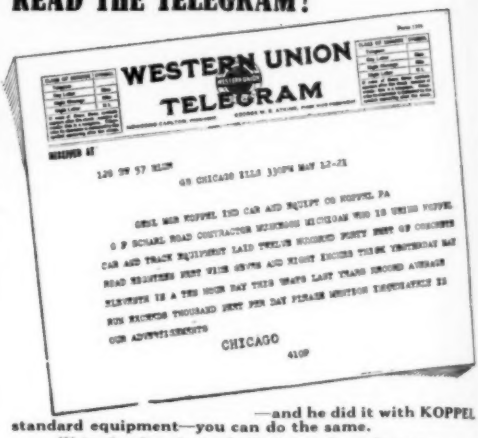
CEMENT MAKING MACHINERY
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Austin Machinery Corp'n., Chicago, Ill.
Fuller-Lehigh Co., Fullerton, Pa.
Vulcan Iron Works, Wilkesbarre, Pa.

PORTER
DEPENDABLE
CONTRACTORS'
DINKEYS—

Always on the job—

H. K. Porter Company
PITTSBURGH, PENNA.

READ THE TELEGRAM!


WESTERN UNION
TELEGRAM

RECEIVED AT

129 PM 57 NLTW

GB CHICAGO ILLS 330PM MAY 12-XX

GENL MGR KOPPEL IND CAR AND EQUIPT CO KOPPEL PA

O P SCHARL ROAD CONTRACTOR MUSKEGON MICHIGAN WHO IS USING KOPPEL CAR AND TRACK EQUIPMENT LAID TWELVE HUNDRED FORTY FEET OF CONCRETE ROAD REGISTERS FEET WITH GUYS AND EIGHT INCHES THICK YESTERDAY MAY ELEVENTH IS A TEN HOUR DAY THIS MAKES LAST YEARS RECORD AVERAGE RUN EIGHTEEN THOUSAND FEET PER DAY PLEASE MENTION KOPPELEQUIP IN OUR ADVERTISEMENTS

CHICAGO

410P

—and he did it with KOPPEL standard equipment—you can do the same.
Write for descriptive bulletins and catalogues.

KOPPEL INDUSTRIAL CAR & EQUIPMENT CO.
KOPPEL, PENNA.
Sales Offices:

30 Church St., **New York**
Peoples Gas Bldg., **Chicago**
Farmers Bank Bldg., **Pittsburgh**
1420 Chestnut St., **Philadelphia**
Book Bldg., **Detroit**
Edw. E. Bacon Co., **51 Minna St., San Francisco.**

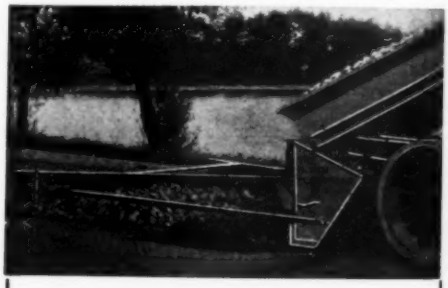
Cummings
Gasoline Locomotives

were the choice of Twohy Brothers, road contractors in Phoenix, Arizona, for the largest concrete road building project ever attempted.

Fourteen locomotives of the six ton type are giving remarkable service with an unusual freedom from repairs and excessive operation costs.

Let us show you how CUMMINGS Locomotives can be used advantageously for your haulage requirements.

THE CUMMINGS MACHINE COMPANY
MINSTER, OHIO
Herbert Crapster, General Manager
1 Madison Ave., New York, N. Y.



The Burch Stone Spreader

—spreads stone automatically as it is dumped.
—distributes stone uniformly to any width desired.
—spreads stone to any depth desired.
—can be adjusted to form road crown.
—spreads from 8 to 16 feet.
—fits any truck.
—saves time, material and labor.
—eliminates rehauling.
—saves enough in two miles to pay for itself.

Write for descriptive circular

THE BURCH PLOW WORKS CO.
Dept. K-6 Crestline, Ohio

CHAINS
American Chain Co., Inc., Bridgeport, Conn.
Columbus McKinnon Chain Co., Columbus, O.
Niagara Metal Stamp. Corp., Niagara Falls, N. Y.
U. S. Chain & Forge Co., Pittsburgh, Pa.

CHAINS, STEEL AND MALLEABLE
Chain Belt Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.

CHECK VALVES
*Mueller Mfg. Co., H., Decatur, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.

CHEMICALS FOR WATER PURIFICATION
*Du Pont de Nemours & Co., E. I., Wilmington, Del.
*Hooker Electrochemical Co., New York.
*Mathieson Alkali Works, Inc., N. Y. C.
*Penna. Salt Mfg. Co., Philadelphia, Pa.
Electro Bleaching Gas Co., New York.
General Chemical Co., New York.

CHIMNEYS, CONCRETE
Heine Chimney Co., Chicago, Ill.
Rust Engineering Co., Pittsburgh, Pa.
Weber Chimney Co., Chicago, Ill.

CHIMNEYS, RADIAL BRICK
Kellogg & Co., M. W., New York.
Rust Engineering Co., Pittsburgh, Pa.
Weber Chimney Co., Chicago, Ill.

CHIMNEYS, STEEL (See Stacks, Steel)

CHLORINATORS
*Wallace & Tiernan Co., Inc., New York.

CHLORINE, LIQUID (See Liquid Chlorine)

CHUTES, CONCRETE
*Ransome Concrete Machy. Co., Dunellen, N. J.
Insley Mfg. Co. Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

CLIPS, WIRE ROPE
American Hoist & Derrick Co., St. Paul, Minn.
American Steel & Wire Co., Chicago, Ill.
Broderick & Bascom Rope Co., St. Louis, Mo.
Carpenter Co., Geo. B., Chicago, Ill.
Leschen & Sons Rope Co., A., St. Louis, Mo.
Marion Malleable Iron Works, Marion, Ind.
Roebling Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.

COAL AND ORE CONVEYING MACHINERY
*Fairfield Engineering Co., Lancaster, Ohio.
*Good Roads Mach'y Co., Philadelphia, Pa.
Barlett & Snow Co., C. O., Cleveland, Ohio.
Blaw-Knox Co., Pittsburgh, Pa.
Brown Hoisting Mchy. Co., Cleveland, O.
Byers Machine Co., J. F., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Gifford-Wood Co., Hudson, N. Y.
Haiss Mfg. Co., Geo., New York.
Hayward Co., New York.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Portable Machinery Co., Passaic, N. J.
Robins Conveying Belt Co., New York.
Webster Mfg. Co., Chicago, Ill.

COCKS, CURB AND CORPORATION
*Mueller Mfg. Co., H., Decatur, Ill.
*Union Water Meter Co., Worcester, Mass.
Chapman Valve Mfg. Co., Indian Orchard, Mass
Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.

COLUMN CLAMPS
Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.
Insley Mfg. Co., Indianapolis, Ind.
Universal Form Clamp Co., Chicago, Ill.

COMPRESSORS, AIR (See Air Compressors)

CONCRETE FLOOR HARDENER
Anti-Hydro Waterproofing Co., New York.
General Fireproofing Co., Youngstown, Ohio.
Granitex Corp., New York.
Horn Co., A. C., Long Island City, N. Y.
Master Builders Co., Cleveland, O.
Sonneborn Sons, Inc., L., N. Y. "Lapidolith"

CONCRETE HEATERS
*Hauck Mfg. Co., Brooklyn, N. Y.

CONCRETE MIXERS
*Austin Machinery Corp'n., Chicago, Ill.
*Gray Iron Fdry. Co., Reading, Pa.
*Jaeger Machine Co., Columbus, O.
*Koehring Machine Co., Milwaukee, Wis.
*Knickerbocker Co., Jackson, Mich.
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Standard Scale & Supply Co., Pittsburgh, Pa.
American Cement Machine Co., Keokuk, Ia.
Atlas Engineering Co., Milwaukee, Wis.
Badger Concrete Mixer Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Iowa.
Contractors' Equipment Co., Keokuk, Ia.
Foote Concrete Mchy. Co., Chicago, Ill.
Judy Mfg. Co., Centerville, Ia.
Lakewood Engineering Co., Cleveland, O.
Lansing Co., Lansing, Mich.
Oshkosh Mfg. Co., Oshkosh, Wis.
Schramm & Son, Inc., Chris D., Philadelphia, Pa.
Smith Co., T. L., Milwaukee, Wis.
Worthington Pump & Mach'y Corp., New York.

CONCRETE REINFORCEMENT
*National Steel Fabric Co., Pittsburgh, Pa.
*Truscon Steel Co., Youngstown, O.
American Steel & Wire Co., Chicago, Ill.
Carnegie Steel Co., Pittsburgh, Pa.
Concrete Steel Co., New York.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Electric Welding Co., Pittsburgh, Pa.
General Fireproofing Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
Ryerson & Son., J. T., Chicago, Ill.
Wickwire Spencer Steel Corp., Worcester, Mass.

CONDENSERS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Cameron Steam Pump Works, A. S., New York.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mach'y Corp., New York.

CONDUIT RODS
*Turbine Sewer Machine Co., Milwaukee, Wis.
*Waldo Bros. & Bond Co., Boston, Mass.
Bissell Co., F., Toledo, Ohio.

CONDUITS
Fibre Conduit Co., Orangeburg, N. Y.
Johns-Manville, Inc., New York City
National Fireproofing Co., New York.
National Metal Molding Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

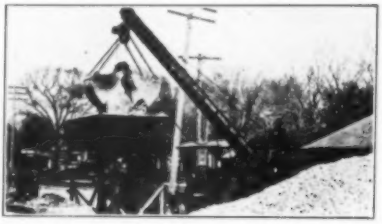
CONTRACTORS' SUPPLIES, DEALERS
Carpenter Co., Geo. B., Chicago, Ill.
Hyland Co., R. H., Chicago, Ill.
Shannon & Co., J. Jacob, Philadelphia, Pa.

CONTRACTORS' USED EQUIPMENT
*Briggs, Inc., Marvin, Brooklyn, New York.
*Craven Co., Frank T., New York.
*Curtiss-Willis Co., New York.
*Forsythe Bros., New York.
*Grey Steel Prod. Co., New York.
*King, Philip T., New York, N. Y.
Contractors' Mach. & Supply Co., Pittsburgh, Pa.
Reading Engineering Co., New York.
Zelnicker Supply Co., Walter A., St. Louis, Mo.

CONVEYORS, BELT
*Good Roads Mach'y Co., Philadelphia, Pa.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Barber-Greene Co., Aurora, Ill.
Gifford Wood Co., Hudson, N. Y.
Goodyear Tire & Rubber Co., Akron, O.
Haiss Mfg. Co., Geo., New York.
Imperial Belting Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Portable Mchy. Co., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
Robins Conv. Belt Co., N. Y. C.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

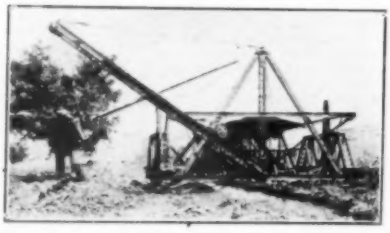
** Indicates that the manufacturer carries an advertisement.* *See index facing inside back cover.*

BAY CITY CRANES



For any material handling job.
Oil engine operated.
Any type of traction.
All steel Boom. ¾ cubic yard Clam Shell.
The most substantially built and lowest priced Motor Crane of this type.

WALKING DREDGES



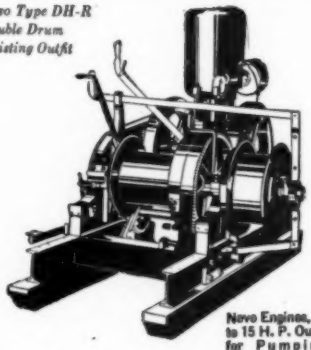
For Drainage, Irrigation, Road or large tile ditches.
Capacities: ½ to 1 Cubic Yard.
Spans the ditch.
Self propelling over rough or swampy ground.

THE ONE MAN EXCAVATOR

For Clay, Sand, or Gravel Pits or Road Contractors. ⅜ cubic yard capacity.

Bay City Dredge Works
2622 Center Ave. Bay City, Mich.

Novo Type DH-R Double Drum Hoisting Outfit



Novo Engines, 1½ to 15 H. P. Outfits for Pumping, Hoisting, Air Compressing, Sawing. Furnished to operate on gasoline, kerosene, natural or artificial gas.

300 Feet a Minute

For road-building work—leveling, filling, stripping off top soil, getting out gravel, handling sand or crushed stone—you'll get mighty satisfactory results from a Novo DH-R Hoisting Outfit.

The load is pulled in by means of a line on the Main Drum. The scraper is returned at a speed of 300 feet per minute by a return line operating on the Retrieving Drum.

This Hoist is compact and portable. Occupying a space only 70 by 80 inches, it can be placed and operated in almost inaccessible locations.

The Main Drum is 12 inches in diameter and 16 inches across, giving ample capacity for carrying 1,050 feet of ½-inch cable.

NOVO ENGINE CO.
Clarence E. Bement, Vice-Pres. & Gen. Mgr.
848 Porter Street Lansing, Mich.
New York Office: 1617 Woolworth Building
Chicago Office: 800 Old Colony Building
London Concrete Machinery Co., Limited, London, Ontario, Canadian Distributors

NOVO RELIABLE POWER

CONVEYORS, BUCKET
*Fairfield Engineering Co., Lancaster, Ohio.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Atlas Engineering Co., Milwaukee, Wis.
Bartlett & Snow Co., C. O., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Gifford Wood Co., Hudson, N. Y.
Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constn. Co., New York.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Republic Rubber Co., Youngstown, O.
Robins Conv. Belt Co., N. Y. C.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CRANES, LOCOMOTIVE
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Thew Shovel Co., Lorain, O.
American Hoist & Derrick Co., St. Paul, Minn.
Brown Hoisting Mchy. Co., Cleveland, O.
Browning Co., Cleveland, O.
Davenport Locomotive Works, Davenport, Ia.
Hanna Eng. Works, Chicago, Ill.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Northwest Engineering Works, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.
Overland Crane Co., Hammond, Ind.
U. S. Crane Co., Chicago, Ill.

CRANES, TRAVELING
*Pawling & Harnischfeger Co., Milwaukee, Wis.
Brown Hoisting Mchy. Co., Cleveland, O.
Chesapeake Iron Works, Baltimore, Md.
Hanna Eng. Works, Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Northern Eng. Works, Detroit, Mich.
Speidel, J. G., Reading, Pa.
Terry Mfg. Co., Edw. F., N. Y. C.
Toledo Crane Co., Toledo, Ohio.
U. S. Crane Co., Chicago, Ill.
Whiting Corp'n, Harvey, Ill.

CRANES, WRECKING
*Bucyrus Co., South Milwaukee, Wis.
Browning Co., Cleveland, O.
Industrial Works, Bay City, Mich.
U. S. Crane Co., Chicago, Ill.

CREOSOTED BLOCKS, TIMBER, ETC.
*Republic Creosoting Co., Indianapolis, Ind.
American Creosoting Co., N. Y. C.
American Creosote Works, Inc., N. Orleans, La.
Jennison-Wright Co., Toledo, O.
Southern Paving Constr. Co., Chattanooga, Tenn.
Southern Wood Pres. Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

CREOSOTING AND CREOSOTING OILS
*Barrett Co., New York.
Am. Creosote Wks., Inc., New Orleans, La.
Jennison-Wright Co., Toledo, O.
Southern Creosoting Co., Ltd., Slidell, La.
Southern Paving Const. Co., Chattanooga, Tenn.
Wyckoff Pipe & Creosoting Co., New York.

CRUSHERS AND PULVERIZERS (See Rock Crushers)

CULVERTS, METAL
*American Cast Iron Pipe Co., Birmingham, Ala
*Dee Co., W. E., Chicago, Ill.
*Good Roads Machinery Co., Philadelphia, Pa.
*Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
*Newport Culvert Co., Newport, Ky.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Truscon Steel Co., Youngstown, O.
*U. S. C. I. Pipe & Fdry. Co., Burlington, N. J.
American Rolling Mill Co., Middletown, O.
Berger Mfg. Co., Canton, O.
Canton Culvert & Silo Co., Canton, O.
Edwards Mfg. Co., Cincinnati, O.
Galion Iron Works & Mfg. Co., Galion, O.
Hardesty Mfg. Co., The R., Denver, Colo.
Madison Foundry Co., Cleveland, O.
Southern Metal Culvert Co., Salisbury, N. C.
Wheeling Corrugating Co., Wheeling, W. Va.
Wood & Co., R. D., Philadelphia, Pa.

CURB BOXES
*Mueller Mfg. Co., Decatur, Ill.
Casey-Hedges Co., Chattanooga, Tenn.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Madison Foundry Co., Cleveland, O.
S. E. T. Valve & Hydrant Co., N. Y. C.
Thompson-Flemming Co., Inc., Buffalo, N. Y.

CURB, STEEL PROTECTED
*Truscon Steel Co., Youngstown, O.
Concrete Steel Co., New York.
National Steel Fabric Co., Pittsburgh, Pa.
Steel Protected Concrete Co., Philadelphia, Pa.

CUTTERS, PIPE, HAND
*Crane Co., Chicago, Ill.
*Smith Mfg. Co., A. P., East Orange, N. J.
Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., New Haven, Conn.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp'n., Greenfield, Mass.
Walworth Mfg. Co., Boston, Mass.

CUTTERS, ROD AND WIRE
*Koehring Machine Co., Milwaukee, Wis.
Carpenter & Co., Geo. B., Chicago, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Worthington Pump & Mchy. Corp., New York.

CUTTING AND WELDING APPARATUS
Macleod Co., Cincinnati, O.
Milburn Co., Alexander, Baltimore, Md.
Prest-O-Lite Co., Inc., New York.

DERRICKS, GUY AND STIFF-LEG
*National Hoisting Engine Co., Harrison, N. J.
American Hoist & Derrick Co., St. Paul, Minn.
Byers Machine Co., Ravenna, O.
Carpenter & Co., Geo. B., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Federal Bridge & Struc. Co., Waukesha, Wis.
Flory Mfg. Co., S., Bangor, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis
Lidgerwood Manufacturing Co., New York.
Lincoln Iron Works, Rutland, Vt.
Smith, Whitcomb & Cook Co., Barrie, Vt.
Superior Iron Works, Superior, Wis.
Terry Mfg. Co., Edw. F., New York.

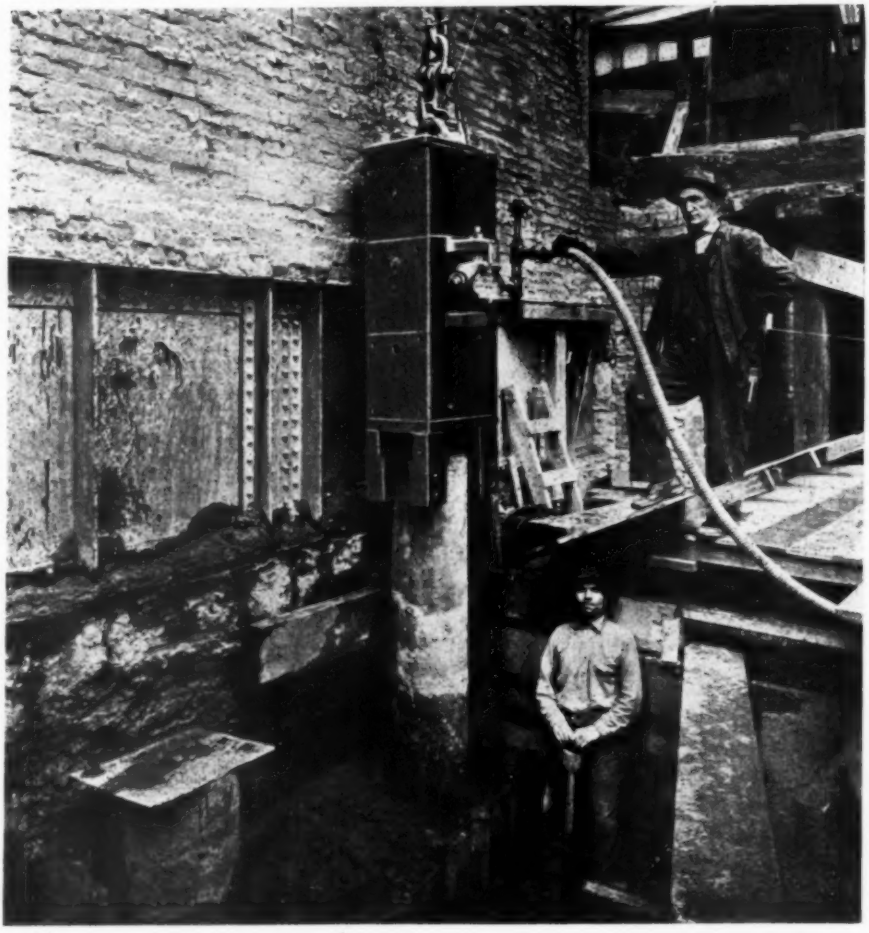
DERRICKS, PIPE LAYING
*Austin Mach. Corp., Chicago, Ill.
*Mueller Mfg. Co., H., Decatur, Ill.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.

DERRICKS, REVOLVING
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Terry Mfg. Co., Edw. F., New York.

DERRICKS, STEEL
*Austin Mach. Corp., Chicago, Ill.
American Hoist & Derrick Co., St. Paul, Minn.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Federal Bridge & Struc. Co., Waukesha, Wis.
Hayward Co., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill.
Terry Mfg. Co., Edw. F., New York.

DERRICKS, STEEL PORTABLE
*Austin Mach. Corp., Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill.

DERRICKS, TRAVELING
*Austin Mach. Corp., Chicago, Ill.
*National Hoisting Engine Co., Harrison, N. J.
American Hoist & Derrick Co., St. Paul, Minn.
Byers Machine Co., J. F., Ravenna, O.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Hoisting Engine Sales Co., New York.
Orton & Steinbrenner Co., Chicago, Ill.
Terry Mfg. Co., Edward F., New York.



On the New Munson Building, New York

Fourteen inch Steel Pipe Piles driven for reinforcement between double rows of 15-in. Steel Sheet Piling grouped to form concrete pier foundations. The piling and pipe piles were both driven to hardpan with a No. 7 hammer swung from the end of a derrick boom. The character of the ground made foundation piling work difficult. The job was completed in record time with the aid of five McKiernan-Terry Pile Hammers which always show up best when the driving is most difficult.

McKIERNAN-TERRY DRILL COMPANY

Rock Drills—Pile Hammers—Lifting Jacks
Mining and Quarrying Machinery

19 PARK ROW, NEW YORK

Works at Dover, N. J.

Agencies in the following Cities:

Boston Chicago Pittsburgh Cleveland Detroit
St. Paul San Francisco Columbus, O.
New Orleans Philadelphia

Foreign Representatives: British Steel Piling Co., London, Eng. Canadian Representative: Canadian Allis-Chalmers, Ltd., Toronto, Ont.

DISINFECTING CHEMICALS
*Barrett Co. New York.
*Mathieson Alkali Works, Inc., New York.
Electro Bleaching Gas Co., New York.

DISTRIBUTING PLANTS, CONCRETE
*Jaeger Machine Co., Columbus, O.
*Koehring Machine Co., Milwaukee, Wis.
*Ransome Concrete Machy. Co., Dunellen, N. J.
Archer Iron Works, Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

DITCHING MACHINES (See Excavators, Ditch and Trench)

DOORS AND SHUTTERS, STEEL ROLLING
Cornell Iron Works, New York.
Kinnear Mfg. Co., Columbus, O.
Variety Mfg. Co., Chicago, Ill.
Wilson Corp., J. G., New York.

DRAFTING MACHINES
Universal Drafting Machine Co., Cleveland, O.

DRAWING MATERIALS
American Blue Print Paper Co., Chicago, Ill.
American Lead Pencil Co., New York.
Defiance Mfg. Co., New York.
Dietzgen Co., E., New York.
Economy Draw, Table & Mfg. Co., Adrian, Mich.
Gurley, W. & L. E., Troy, N. Y.
Hamilton Mfg. Co., Two Rivers, Wis.
Keuffel & Esser Co., Hoboken, N. J.
Kolesch & Co., New York.
Lietz Co., A., San Francisco, Cal.
Spaulding-Moss Co., Boston, Mass.
Weber & Co., F., Philadelphia, Pa.

DREDGES
*Bay City Dredge Works, Bay City, Mich.
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
Ellicott Machine Corp'n., Baltimore, Md.
Hayward Co., New York.
Lidgerwood Mfg. Co., New York.
Osgood Co., The, Marion, O.
Stockton Iron Works, Stockton, Cal.
Superior Iron Works, Superior, Wis.
Vulcan Iron Works, Jersey City, N. J.

DREDGES, DIPPER
*Austin Machinery Corp'n., Chicago, Ill.
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
American Steel Dredge Co., Fort Wayne, Ind.
Fairbanks Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.

DREDGES, HYDRAULIC
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
Ellicott Mach. Corp., Baltimore, Md.
Fairbanks Steam Shovel Co., Marion, O.
Morris Machine Works, Baldwinsville, N. Y.

DRILLS, AIR
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, Ohio.
Denver Rock Drill Mfg. Co., Denver, Colo.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

DRILLS, CORE
*McKiernan-Terry Drill Co., New York.
Dobbins Core Drill Co., Inc., New York.
Ingersoll-Rand Co., New York.
Standard Diamond Drill Co., Chicago, Ill.

DRILLS, HAMMER
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Denver Rock Drill Mfg. Co., Denver, Colo.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

DRILLS, ROCK
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Rock Drill Co., Cleveland, Ohio.
Denver Rock Drill Mfg. Co., Denver, Colo.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.
Wood Drill Works, Paterson, N. J.

DRILLS FOR WELLS AND BLAST HOLES
(See Well Drilling Machinery)

DRUMS, HOLDING
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Monighan Machine Co., Chicago, Ill.

DRYERS, ASPHALT AND CEMENT
*Allis-Chalmers Co., Milwaukee, Wis.
American Blower Co., Detroit, Mich.
American Process Co., New York.
Atlas Dryer Co., Cleveland, O.
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, O.
Ruggles-Coles Eng. Co., New York.
Variety Iron & Steel Works, Cleveland, O.

DUMP BODIES FOR MOTOR TRUCKS
*Heil Company, Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
American Truck Body Co., Inc., Martinville, Va.
Archer Iron Works, Chicago, Ill.
Auto Truck Steel Body Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Horizontal Hydraulic Hoist Co., Milwaukee, Wis.
Lee Trailer & Body Co., Chicago, Ill.
Pechstein Iron Works, Keokuk, Iowa.
Simplex Mfg. Co., Connesutville, Pa.
Van Dorn Iron Wks., Cleveland, Ohio.
Wood Hydraulic Hoist & Body Co., Detroit, Mich.

DUMP CARTS AND WAGONS
*Acme Road Machinery Co., Frankfort, N. Y.
*Austin Western Road Mchy. Co., Chicago, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Tiffin Wagon Co., Tiffin, Ohio.
Acme Wagon Co., Emigsville, Pa.
Arcadia Trailer Corp., Newark, N. Y.
Austin Mfg. Co., Chicago, Ill.
Eagle Wagon Works, Auburn, N. Y.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
Stroud & Co., Omaha, Nebr.
Watson Products Corp., Canastota, N. Y.

DUST LAYING COMPOUNDS
*Barrett Co., New York.
*Dow Chemical Co., Midland, Mich.
*Dustoline for Roads Co., Summit, N. J.
*Standard Oil Co. of Indiana, Chicago, Ill.
*Texas Co., New York City.
Semet-Solvay Co., Solvay, N. Y.

DYNAMITE (See Explosives)

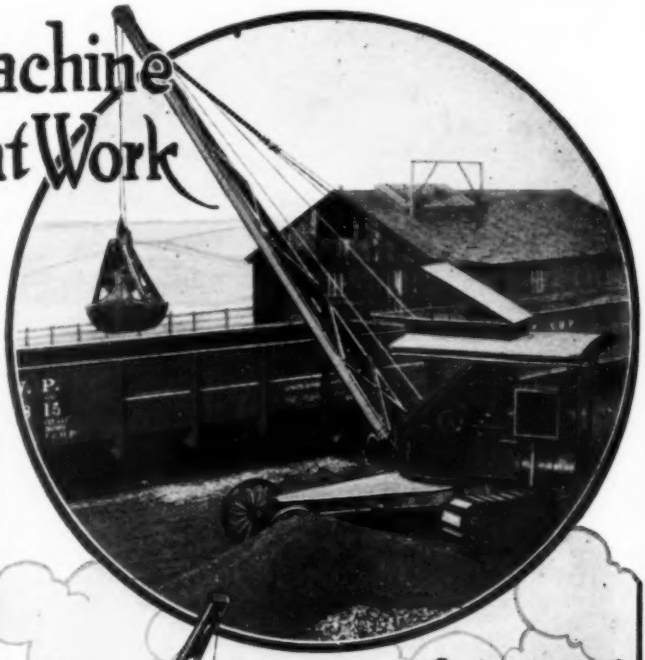
EJECTORS, SEWAGE
*Pacific Flush Tank Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC GENERATORS AND MOTORS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Ideal Elec. & Mfg. Co., Mansfield, O.
Triumph Electric Co., Cincinnati, O.
Western Electric Co., New York.

ELECTRIC LAMPS
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ELECTRIC LIGHTING PLANTS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
*Worthington Pump & Mach. Corp., New York City
Western Electric Co., New York

Same Machine Different Work



A highway engineer or contractor uses P & H Excavator-Cranes mostly for making cuts, grading, filling-in, shouldering-up, and handling materials as sand, gravel, structural pieces; general contractors do some piledriving in addition; industrial plants handle coal, ashes, and raw materials used in manufacture; drainage and reclamation engineers add a few uses of their own; and so it goes.

There seems to be no limit to the number of uses by which this P & H Crane can be made to earn big dividends by doing things well and fast.

If you are not the owner of a P & H, you ought to be. Send for Bulletin 6X.

Excavating Machinery Division
PAWLING & HARNISCHFEGER CO.
New York: 50 Church St.; Philadelphia, Stephen Girard Bldg.; Pittsburgh, Fidelity Bldg.; Chicago, Monadnock Blk.; New Orleans, Whitney Central Bldg.; San Francisco, Monadnock Bldg.; Los Angeles, Central Bldg.; Seattle, L. C. Smith Bldg.; Portland, Yeon Bldg.
In Milwaukee, Wis., since 1884

P&H Excavator-Crane

ELECTRIC SUPPLIES, METERS, ETC.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Bissell Co., F., Toledo, Ohio.

ELECTRIC TRANSFORMERS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*General Electric Co., Schenectady, New York.
*Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Kuhlman Electric Co., Bay City, Mich.

ELECTRIC WIRES AND CABLES. (See "Wire and Cable")

ELEVATORS, BUCKET
*Austin Western Road Machy. Co., Chicago, Ill.
*Fairfield Engineering Co., Lancaster, Ohio.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Littleford Bros., Cincinnati, Ohio.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Atlas Eng. Co., Milwaukee, Wis.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Robins Conv. Belt Co., N. Y. C.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.
Worthington Pump & Mchy. Corp., New York.

ELEVATORS, CONTRACTING MATERIAL
*Fairfield Engineering Co., Lancaster, Ohio.
*Ransome Concrete Machy. Co., Dunellen, N. J.
American Hoist & Derrick Co., St. Paul, Minn.
Byers Machine Co., J. F., Ravenna, O.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Insley Mfg. Co., Indianapolis, Ind.

ELEVATORS, FACTORY
Otis Elevator Co., New York.
Ridgway & Son Co., C., Coatesville, Pa.
Speidel, J. G., Reading, Pa.
Webster Mfg. Co., Chicago, Ill.

ENGINEERS, ARCHITECTS, ETC.
*Banks & Craig, New York.
*Fuller & McClintock, New York.
*Gannett, Seelye & Fleming, Harrisburg, Pa.
*Glaeser, Frederick, Trenton, N. J.
*Gulick-Henderson Co., New York.
*Hansen, A. E., New York.
*Higgins, J. Wallace, New York.
*Hill & Ferguson, New York.
*Johnson, Geo. A., New York.
*McClure-Greene Eng. Co., Worcester, Mass.
*Pease Laboratories, Inc., New York.
*Pollock, C. D., New York.
*Smith & Co., C. E., St. Louis, Mo.
*Robinson, Geo. L., New York.
*Universal Audit Co., New York.

ENGINES, GAS AND GASOLINE
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*Holt Mfg. Co., Peoria, Ill.
*Novo Engine Co., Lansing, Mich.
*Standard Scale & Supply Co., Pittsburgh, Pa.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York.
Domestic Engine & Pump Co., Shippensburg, Pa.
Foos Gas Engine Co., Springfield, Ohio.
Gade Bros. Mfg. Co., Iowa Falls, Iowa.
"New-Way" Motor Co., Lansing, Mich.
Universal Motor Co., Oshkosh, Wis.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mchy. Corp., New York.

ENGINES, HIGH DUTY WATER-WORKS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*De Laval Steam Turbine Co., Trenton, N. J.
*Fairbanks, Morse & Co., Chicago, Ill.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Worthington Pump & Mchy. Corp., New York.

ENGINES, OIL
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Bush-Sulzer Bros.-Diesel Eng. Co., St. Louis, Mo.
*Fairbanks, Morse & Co., Chicago, Ill.
*Midwest Engine Co., Indianapolis, Ind.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Advance Rumely Thresher Co., La Porte, Ind.
Bessemer Gas Eng. Co., Grove City, Pa.
Chicago Pneumatic Tool Co., Chicago, Ill.
De La Vergne Machine Co., New York.
Foos Gas Engine Co., Springfield, O.
Ingersoll-Rand Co., New York.
International Harvester Co. of Am., Chicago, Ill.
Machinery Sales Co., Chicago, Ill.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mchy. Corp., New York.

ENGINES, PUMPING
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*American Well Works, Aurora, Ill.
*Dayton-Dowd Co., Quincy, Ill.
*Fairbanks Morse & Co., Chicago, Ill.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
American Gas Engine Co., Kansas City, Mo.
Deming Co., Salem, O.
Enterprise Mchy. Co., Minneapolis, Minn.
United Iron Works, Inc., Kansas City, Mo.
Weinman Pump Mfg. Co., Columbus, O.
Worthington Pump & Mchy. Corp., New York.

ENGINES, STEAM
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Nordberg Mfg. Co., Milwaukee, Wis.
Ball Engine Co., Erie, Pa.
Dake Engine Co., Grand Haven, Mich.
Erie Pump & Engine Co., Medina, N. Y.
Filer-Stowell Co., Milwaukee, Wis.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Leffel Co., J., Springfield, O.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Vilter Mfg. Co., Milwaukee, Wis.

ENGINES, TRACTION
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Holt Mfg. Co., Peoria, Ill.
Oliver Tractor Co., Knoxville, Tenn.
Phoenix Mfg. Co., Eau Claire, Wis.

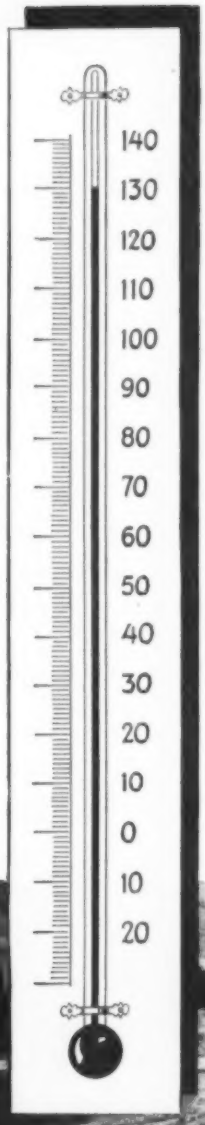
EXCAVATING MACHINERY. (See Names Under Excavators, also Steam Shovels)

EXCAVATORS, CABLEWAY
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
Ball Eng. Co., Erie, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Byers Machine Co., J. F., Ravenna, O.
Lidgerwood Mfg. Co., New York.
Smith Co., T. L., Milwaukee, Wis.

EXCAVATORS, DITCH AND TRENCH
*Austin Machinery Corp'n., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Bay City Dredge Works, Bay City, Mich.
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Russell Grader Mfg. Co., Minneapolis, Minn.
American Hoist & Derrick Co., St. Paul, Minn.
Ball Engine Co., Erie, Pa.
Buckeye Traction Ditcher Co., Findlay, O.
Byers Machine Co., J. F., Ravenna, O.
Clyde Iron Works, Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Fairbanks Steam Shovel Co., Marion, O.
Hayward Co., The, New York City.
Keystone Driller Co., Beaver Falls, Pa.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.

EXCAVATORS, DRAG-LINE
*Austin Machinery Corp'n., Chicago, Ill.
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
Browning Co., Cleveland, O.
Byers Machine Co., J. F., Ravenna, O.
Clyde Iron Works, Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Gade, C. L., Iowa Falls, Iowa.
Hayward Co., New York.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.
Smith Co., T. L., Milwaukee, Wis.

EXPANDED METAL
*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Northwestern Expanded Metal Co., Chicago, Ill.



Carey Elastite

Reg. U.S. Patent Office

EXPANSION JOINT

Changing Temperatures destroy roads

ELASTITE, always elastic and always tight is able to absorb road expansion and contraction due to changes in temperature because it is made of a flexible asphalt compound. IT IS THE ONLY EXPANSION JOINT ACTUALLY COMPRESSIBLE WITHOUT DISPLACING.

This tempered compound sandwiched between two layers of saturated asphalt felt, will compress without melting or running in the hottest weather.

It will adhere to the paving and stretch without cracking in the coldest winter temperatures.

Better yet, it retains this elasticity year after year, and at the same time withstands the wear of traffic as successfully as the street itself.

It comes to the job in strips of the length, depth, and thickness desired and is placed by one man without holding up the work of the paving gang.

Elastite is economical to install, ideal in service, and is a demonstrated success on Dixie, Lincoln, Pike's Peak, Pacific, Southern National, Atlantic, and other important highways. Used in roads, streets, sidewalks, bridges, dams, viaducts, and large buildings to absorb stresses.

For particulars, write

THE PHILIP CAREY COMPANY

9 Wayne Avenue, Lockland, Cincinnati, Ohio

6-21

EXPANSION JOINT MATERIAL
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, Ohio.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Texas Company, New York.
*Truscon Steel Co., Youngstown, O.
*Waring-Underwood Co., Philadelphia, Pa.

EXPLOSIVES
*Du Pont de Nemours & Co., E. I., Wilmington, Del.
Atlas Powder Co., Wilmington, Del.
Giant Powder Co., Cons., San Francisco, Cal.
Hercules Powder Co., Wilmington, Del.

FENCING
American Steel & Wire Co., Chicago, Ill.
Anchor Post Iron Works, New York.
Cyclone Fence Co., Waukegan, Ill.
Frost-Superior Fence Co., Cleveland, O.
Indiana Steel & Wire Co., Muncie, Ind.
Kitselman Bros., Muncie, Ind.
Pittsburgh Steel Co., Pittsburgh, Pa.
Stewart Iron Works Co., Cincinnati, Ohio.
Texas Cyclone Fence Co., Fort Worth, Tex.
Wickwire Spencer Steel Corp'n, Worcester, Mass.

FILING EQUIPMENT, STEEL
*Econ. Drawing Table & Mfg. Co., Adrian, Mich.
Art Metal Constr. Co., Jamestown, N. Y.
Berger Mfg. Co., Canton, O.
Van Dorn Iron Works, Cleveland, O.

FILTERS, OIL
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

FILTERS, WATER
*Norwood Engineering Co., Florence, Mass.
*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.
American Water Softener Co., Philadelphia, Pa.
Hygeia Filter Co., Detroit, Mich.
International Filter Co., Chicago, Ill.
N. Y. Continental Jewel Filtr. Co., Nutley, N. J.
Roberts Filter Co., Darby, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.

FIRE EXTINGUISHERS, CHEMICAL
American-La France Fire Eng. Co., Elmira, N. Y.
Childs Co., O. J., Utica, N. Y.
Cross Mfg. Co., C. J., Inc., New York.
Foamite Firefoam Co., New York.
Pyrene Mfg. Co., New York.

FIREPROOF BUILDING MATERIAL
*Delaware Clay Products Co., Pittsburgh, Pa.
*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Detroit Steel Prod. Co., Detroit, Mich.
General Fireproofing Co., Youngstown, O.
Keasbey & Mattison Co., Ambler, Pa.
Kinnear Mfg. Co., Columbus, O.
National Fireproofing Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.

FIRST AID EQUIPMENT
American-La France Fire Eng. Co., Elmira, N. Y.

FLEXIBLE JOINTS
*Central Foundry Co., New York.
*Crane Co., Chicago, Ill.
*United Lead Company, New York.
*U. S. C. I. Pipe & Fdry Co., Burlington, N. J.
Coldwell-Wilcox Co., Newburgh, N. Y.
Lunkenheimer Co., Cincinnati, O.

FLOORS, WOOD BLOCK
*Barrett Co., New York.
Jennison-Wright Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Southern Wood Pres. Co., Atlanta, Ga.

FLUSH TANKS
*Pacific Flush Tank Co., Chicago, Ill.

FLUSHERS, STREET
*Kinney Mfg. Co., Boston, Mass.
*Municipal Supply Co., South Bend, Ind.
*Tiffin Wagon Co., Tiffin, O.
Etnyre, E. D., & Co., Oregon, Ill.

FORGES
*Hauck Mfg. Co., Brooklyn, N. Y.
Buffalo Forge Co., Buffalo, N. Y.

FORM CLAMPS
Insley Mfg. Co., Indianapolis, Ind.
Marion Malleable Iron Works, Marion, Ind
Universal Form Clamp Co., Chicago, Ill.

FORMS, CONSTRUCTION
*Heltzel Steel Form & Iron Co., Warren, O.
*Truscon Steel Co., Youngstown, O.
Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.
Metal Forms Corp., Milwaukee, Wis.

FURNITURE AND FILES, STEEL
Art Metal Constn. Co., Jamestown, N. Y.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works, Cleveland, O.

GARBAGE DISPOSAL
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
Decarie Incinerator Co., Minneapolis, Minn.
Destructor Co., New York.
Jeffrey Manufacturing Co., Columbus, O.
Morse-Boulger Destructor Co., New York.
Nye Odorless Crematory Co., Macon, Ga.

GARBAGE WAGONS
*Austin Western Road Mchy. Co., Chicago, Ill.
*Federal Motor Truck Co., Detroit, Mich.
*Tiffin Wagon Co., Tiffin, O.
*White Co., Cleveland, O.
Autocar Co., Ardmore, Pa.
Four Wheel Drive Auto Co., Clintonville, Wis.
Holzbog & Bro., Geo. H., Jeffersonville, Ind.
Lee Trailer & Body Co., Chicago, Ill.
Service Motor Truck Co., Wabash, Ind.
Watson Products Corp., Canastota, N. Y.

GAS ENGINES. (See Engines, Gas and Gasoline.)

GAS METERS
*Builders Iron Foundry, Providence, R. I.
*General Electric Co., Schenectady, New York.
*Pittsburg Meter Co., East Pittsburgh, Pa.

GAS PRODUCERS
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Camden Iron Works, Camden, N. J.

GASOLINE PUMPING ENGINES
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*American Well Works, Aurora, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Waldo Bros. & Bond Co., Boston, Mass.
Worthington Pump & Mchy. Corp., New York.

GASOLINE STORAGE TANKS
*Chicago Bridge & Iron Works, Chicago, Ill.
*Heil Co., Milwaukee, Wis.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros., Cincinnati, O.
Biggs Boiler Works, Akron, Ohio.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Byers Mach. Co., J. F., Ravenna, Ohio.
Scaife & Sons, Wm. B., Oakmont, Pa.
United Iron Works, Kansas City, Mo.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

GATES, SLUICE
*Columbian Iron Works, Chattanooga, Tenn.
*Crane Co., Chicago, Ill.
*Eddy Valve Co., Waterford, N. Y.
*Kennedy Valve Mfg. Co., Elmira, N. Y.
*Rensselaer Valve Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., Boston, Mass.
Coldwell-Wilcox Co., Newburgh, N. Y.
Hardesty Mfg. Co., L., Denver, Col.
Ludlow Valve Mfg. Co., Troy, N. Y.
Wood & Co., R. D., Philadelphia, Pa.

GAUGES, RECORDING, PRESSURE, STEAM
Bristol Co., Waterbury, Conn.
Crosby Steam Gauge & Valve Co., Boston, Mass
Marsh & Co., Jas. P., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y
U. S. Gauge Co., New York.

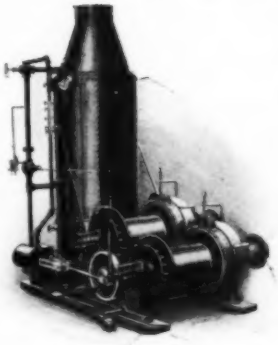
** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

Features Worth Investigating

National Hammers are accelerated by steam or air ASSISTED BY GRAVITY. 150 to 400 HEAVY BLOWS per minute. Work is driven faster than by any other method. Brooming or splitting impossible. Open face construction permits easy and quick lubrication and adjustment. Valve action positive. May be inverted and used for PULLING.

Hoisting Engines for every purpose, from smallest to most powerful. Steam, Gasolene and Electrically driven. All parts positively interchangeable.

Send for new catalogs for complete information.



National Hoisting Engine Co.

Office and Works

Harrison New Jersey

NATIONAL

DUMPING EQUIPMENT FOR EVERY NEED

Quality TANKS BODIES & HOISTS "Made by Heil"

Bodies for Road Building, Asphalt, Gravel, Garbage, Coal and Brick.

Combination Bodies for General Trucking.

Welded Storage Tanks for Road Oil.

The Heil Gravity Body is especially serviceable in building concrete roads. It can be mounted on any make of truck with "U" bolts which are furnished. The body is made of No. 12 gauge steel electrically welded thruout to make it water tight.

Special control rods allow a dumping angle of 80 degrees.

The price of a one yard body complete is $100.00.

WRITE FOR LITERATURE.

THE HEIL CO.

1243 26th AVENUE MILWAUKEE, WIS.

BAKER MANEY Self-Loading SCRAPERS

They dig, load, haul, dump and spread

Write to

THE BAKER MFG. CO.

503 Stanford Ave., Springfield, Ill.

Truscon Curb Bars

Protect and reinforce concrete curbs. Strong, rigid, convenient, easy to install. Furnished straight or curved.

TRUSCON STEEL CO.

Youngstown, Ohio

TRUSCON STEEL CO. TRUSCON BUILDING PRODUCTS

GAUGES, WATER
Ashton Valve Co., Boston, Mass.
Bristol Co., Waterbury, Conn.
Clow & Sons, J. B., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
United States Gauge Co., New York.
Walworth Mfg. Co., Boston, Mass.

GAUGES, SURFACE, RESERVOIR AND SPECIAL WATER-WORKS
*Builders Iron Foundry, Providence, R. I.
*Simplex Valve & Meter Co., Philadelphia, Pa.
Clark Co., H. W., Mattoon, Ill.

GLASS, FIREPROOF. (See Wire Glass.)

GRADERS, ROAD
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Good Roads Mchy. Co., Philadelphia, Pa.
*Holt Mfg. Co., Peoria, Ill.
*Koehring Machine Co., Milwaukee, Wis.
*Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Machine Co., J. I., Racine, Wis.
Kilbourne & Jacobs Mfg. Co., Columbus, O.

GRINDERS AND SAND RAMMERS
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Ingersoll-Rand Co., New York, N. Y.
Sullivan Machinery Co., Chicago, Ill.

GYPSUM PRODUCTS
U. S. Gypsum Co., Chicago, Ill.

HAMMERS, STEAM, PILE. (See Pile Hammers, Steam.)

HEAT INSULATING MATERIAL
*Carey Co., Philip, Cincinnati, Ohio.
John-Manville, Inc., New York.

HEATING KETTLES. (See Kettles)

HOISTS, BELT-DRIVEN
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Mfg. Co., New York.
Mundy Hoisting Engine Co., J. S., Newark, N. J.

HOISTS, CONCRETE, TOWER
*Ransome Concrete Machy. Co., Dunellen, N. J.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

HOISTS, CONTRACTORS', ELECTRIC
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*National Hoisting Engine Co., Harrison, N. J.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
American Hoist & Derrick Co., St. Paul, Minn.
Byers Machine Co., J. F., Ravenna, O.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Flory Mfg. Co., S., Bangor, Pa.
Ingersoll-Rand Co., New York.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.
Northern Eng. Works, Detroit, Mich.

HOISTS, CONTRACTORS', GASOLINE
*Austin Mach. Corp., Chicago, Ill.
*National Hoisting Engine Co., Harrison, N. J.
*Novo Engine Co., Lansing, Mich.
*Waldo Bros. & Bond Co., Boston, Mass.
*Standard Scale & Supply Co., Pittsburgh, Pa.
American Cement Mach. Co., Keokuk, Ia.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Clyde Iron Works, Duluth, Minn.
Domestic Engine & Pump Co., Shippensburg, Pa.
Flory Mfg. Co., S., Bangor, Pa.
Lansing Co., Lansing, Mich.
Lidgerwood Mfg. Co., New York.
Monighan Machine Co., Chicago, Ill.
Mundy Hoisting Engine Co., J. S., Newark, N. J.
O. K. Clutch & Mach. Co., Columbia, Pa.
Schramm & Son, Inc., Chris. D., Philadelphia, Pa.

HOISTS, CONTRACTORS', STEAM
*Austin Mach. Corp., Chicago, Ill.
*National Hoisting Engine Co., Harrison, N. J.
American Hoist & Derrick Co., St. Paul, Minn.
Byers Machine Co., J. F., Ravenna, O.
Clyde Iron Works, Duluth, Minn.
Denver Rock Drill Mfg. Co., Denver, Colo.
Flory Mfg. Co., S., Bangor, Pa.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.

HOISTS, HYDRAULIC FOR MOTOR TRUCKS
*Heil Co., The Milwaukee, Wis.
Horizontal Hydr. Hoist Co., Milwaukee, Wis.
Wood Hydr. Hoist & Body Co., Detroit, Mich.

HOISTS, PNEUMATIC
Chicago Pneumatic Tool Co., New York.
Denver Rock Drill Mfg. Co., Denver, Colo.
Detroit Hoist & Machine Co., Detroit, Mich.
Flory Mfg. Co., Bangor, Pa.
Hanna Eng. Works, Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Northern Engineering Works, Detroit, Mich.
Worthington Pump & Mchy. Corp., New York.

HOLLOW TILE
*Dee Co., Wm. E., Chicago, Ill.
*Delaware Clay Products Co., Pittsburgh, Pa.
Bannon Pipe Co., P., Louisville, Ky.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Medal Paving Brick Co., Cleveland, Ohio.
Metropolitan Paving Brick Co., Canton, Ohio.
National Fireproofing Co., Pittsburgh, Pa.

HOPPERS, CONCRETE
*Koehring Mach. Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
*Ransome Concrete Machy. Co., Dunellen, N. J.
Honhorst Co., Jos., Cincinnati, Ohio.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

HOSE, AIR
Cincinnati Rubber Mfg. Co., Cincinnati, O.
Goodyear Tire & Rubber Co., Akron, O.
Ingersoll-Rand Co., New York.
Penna Flexible Metallic Tubing Co., Phila., Pa.
Republic Rubber Co., Youngstown, O.
U. S. Rubber Co., New York

HOUSES, PORTABLE. (See Buildings, Portable)

HYDRANTS, FIRE
*Columbian Iron Works, Chattanooga, Tenn.
*Eddy Valve Mfg. Co., Waterford, N. Y.
*Kennedy Valve Mfg. Co., Elmira, N. Y.
*Norwood Engineering Co, Florence, Mass.
*Rensselaer Valve Co., Troy, N. Y.
*Smith Mfg. Co., A. P., East Orange, N. J.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Darling Valve Mfg. Co., Williamsport, Pa.
Iowa Valve Co., Oskaloosa, Ia.
Ludlow Valve Mfg. Co., Troy, N. Y.
Wood & Co., R. D., Philadelphia, Pa.

INCINERATORS, GARBAGE. (See Garbage Disposal)

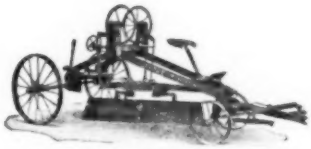
INDICATOR POSTS. (See Valves)

INSPECTING LABORATORIES
Allentown Testing Laboratories, Allentown, Pa.
Conard & Busby, Burlington, N. J.
Hunt & Co., Robert W., Chicago, Ill.
Pittsburgh Testing Laboratories, Pittsburgh, Pa.

INSTRUMENTS AND SUPPLIES. (Surveyors' and Engineers')
Ainsworth & Sons, Wm., Denver, Col.
Aloe Co., A. S., St. Louis, Mo.
Berger & Sons, C. L., Boston, Mass.
Brandis & Sons Mfg. Co., Brooklyn, N. Y.
Buff & Buff Mfg. Co., Boston, Mass.
Dietzgen Co., Eugene, Chicago, Ill.
Gurley, W. & L. E., Troy, N. Y.
Keuffel & Esser Co., Hoboken, N. J.
Kolesch & Co., New York.
Lietz Co., A., San Francisco, Cal.

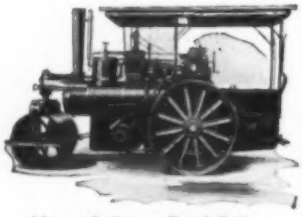
ONE OF OUR SALESMEN SAID

I like to sell our line of Road Building and Contractors' Machinery because it is complete, and I can always offer the customer just what he wants.



The Little Winner Road Grader. Weight 1600 pounds. Blade 6 ft. long.

Our line *is* complete. We furnish portable and stationary Rock Crushing Plants in many different sizes. Tandem and Macadam Steam Road Rollers. Six different sizes of Road Graders. Several types of Road Drags. Oiling Machinery, Heating Kettles, Dump Wagons, Sprinklers, Sweepers and Culvert Pipe.



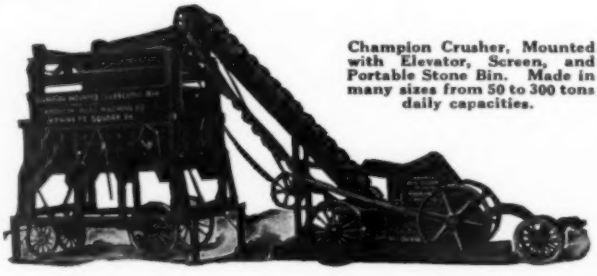
Monarch Steam Road Roller. Made in 10 and 12 ton sizes.

But,—There is something more than a complete line that accounts for the popularity of our goods. We build high class goods. Sell them at reasonable prices, and we give service with every article that goes out of our plants.

Ask for catalogue.

Everything for the Road Maker.

It will interest you.



Champion Crusher, Mounted with Elevator, Screen, and Portable Stone Bin. Made in many sizes from 50 to 300 tons daily capacities.

The Good Roads Machinery Company, Inc.

821 Bulletin Building, Philadelphia, Pa.

BRANCH OFFICES IN ALL PRINCIPAL CITIES.

Leupold & Voelpel, Portland, Ore.
Pfister, Wm. H., Cincinnati, O.
Ulmer, J. C., Co., Cleveland, Ohio.
Weber & Co., F., Philadelphia, Pa.
White Co., David, Milwaukee, Wis.
Wissler Instrument Co., St. Louis, Mo.

IRON WORK, STRUCTURAL AND ORNAMENTAL
(See Bridges and Buildings)

JACKS, LIFTING
*Duff Mfg. Co., Pittsburgh, Pa.
*McKiernan-Terry Drill Co., New York.
Buda Company, Chicago, Ill.
Iron City Prod. Co., Pittsburgh, Pa.
Joyce-Cridland Co., Dayton, O.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Norton, Inc., A. O., Boston, Mass.
Watson-Stillman Company, New York.

JACKS, PIPE FORGING
*Duff Mfg. Co., Pittsburgh, Pa.
Clark Co., H. W., Mattoon, Ill.

JOINTS, EXPANSION PAVING
*Carey Company, Philip, Cincinnati, O.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Waring-Underwood Co., Philadelphia, Pa.

JOINTS, FLEXIBLE PIPE. (See Flexible Joints.)

KETTLES, FOR ASPHALT AND TAR HEATING
*Acme Road Mach. Co., Frankfort, N. Y.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Good Roads Machinery Co., Kennett Square, Pa.
*Hauck Mfg. Co., Brooklyn, N. Y.
*Littleford Bros., Cincinnati, O.
*Tarrant Mfg. Co., Saratoga Springs, N. Y.
Connery & Co., Inc., Philadelphia, Pa.
Honhorst Co., Jos., Cincinnati, Ohio.
Macleod Co., Cincinnati, O.
Stuebner Iron Wks., G. L., Long Island City, N. Y.

LATH, METAL
*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Bostwick Steel Lath Co., Niles, O.
Consol. Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
General Fireproofing Co., Youngstown, O.
Milwaukee Corrugating Co., Milwaukee, Wis.
Northwestern Expanded Metal Co., Chicago, Ill.
Penn Metal Co., Boston, Mass.
Sykes Metal Lath & Roofing Co., Niles, O.
Wickwire Spencer Steel Corp., Worcester, Mass.
Youngstown Pressed Steel Co., Warren, O.

LEADITE
*Leadite Co., The, Philadelphia, Pa.

LEAD-MELTING FURNACES
*Hauck Mfg. Co., Brooklyn, N. Y.
Berns, Otto, Co., Newark, N. J.
Chicago Flexible Shaft Co., Chicago, Ill.
Gilbert & Barker, Springfield, Mass.
Stuebner Iron Works, Long Island City, N. Y.

LEAK FINDERS
*Pitometer Company, New York.
Clark & Co., H. W., Mattoon, Ill.

LETTERS AND FIGURES, METAL
Niagara Metal Stamp. Corp., Niagara Falls, N. Y.

LIGHTS, CONTRACTORS
*General Elec. Co., Schenectady, N. Y.
*Hauck Mfg. Co., Brooklyn, N. Y.
Carbic Mfg. Co., Duluth, Minn.
Macleod Co., Cincinnati, O.
Milburn Co., Alex., Baltimore, Md.
Prest-O-Lite Co., Inc., New York.

LIGHTING STANDARDS
*Electric Railway Equip. Co., Cincinnati, O.
*King Mfg. Co., Chicago, Ill.
*Stewart Iron Works Co., Cincinnati, O.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Clow & Sons, J. B., Chicago, Ill.
Union Metal Mfg. Co., Canton, O.

LIQUID CHLORINE
*Electro Bleaching Gas Co., New York.
*Hooker Electrochemical Co., New York.
*Mathieson Alkali Works, Inc., New York.
*Penna. Salt Mfg. Co., Philadelphia, Pa.

LOADERS, GRAVEL AND WAGON
*Austin Machinery Corp'n., Chicago, Ill.
*Fairfield Engineering Co., Lancaster, O.
*Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
*Bay City Dredge Works, Bay City, Mich.
Atlas Engineering Co., Milwaukee, Wis.
Barber-Greene Co., Aurora, Ill.
Bonney Supply Co., Inc., Rochester, N. Y.
Economy Excavator Co., Iowa Falls, Iowa.
Gifford-Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Haiss Mfg. Co., Geo., New York.
Lee Trailer & Body Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Portable Mchy. Co., Passaic, N. J.
Sackett Screen & Chute Co., H. B., Chicago, Ill.
Sauerman Bros., Chicago, Ill.
Smith Co., T. L., Milwaukee, Wis.

LOCK BAR STEEL PIPE
*East Jersey Pipe Co., New York

LOCKERS, STEEL
Hart & Hutchinson Co., New Britain, Conn.
Medart Mfg. Co., Fred., St. Louis, Mo.

LOCOMOTIVES, FOR CONTRACTORS, ETC.
*Austin Mach. Corp., Chicago, Ill.
*Cummings Mach. Co., Minster, O.
*Koppel Industrial Car & Equip. Co., Koppel, Pa.
*Porter Co., H. K., Pittsburgh, Pa.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
American Locomotive Co., New York, N. Y.
Baldwin Locomotive Works, Philadelphia, Pa.
Burton Eng. & Mach. Co., Cincinnati, O.
Crapster, Herbert, New York.
Davenport Locomotive Works, Davenport, Ia.
Fate-Root-Heath Co., Plymouth, O.
Hadfield-Penfield Steel Co., Bucyrus, O.
Lima Locomotive Wks., Lima, O.
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Co., Geo. D., Rochelle, Ill.

LUMBER, HEAVY CONSTRUCTION
Brown Co., Portland, Me.
Crowell & Spencer Lumber Co., Long Leaf, La.
Great Southern Lumber Co., Bogalusa, La.
Industrial Lumber Co., Elizabeth, La.
Long Bell Lumber Co., Kansas City, Mo.
Sargent Lumber Co., Little Rock, Ark.
Sterner Co., Inc ., E. J., New York.
Weyerhaeuser Sales Co., Spokane, Wash.

LUMBER, STEEL
*Truscon Steel Co., Detroit, Mich.
Berger Mfg. Co., Canton, O.
General Fireproofing Co., Youngstown, O.
National Pressed Steel Co., Massillon, O.
Northwestern Exp. Metal Co., Chicago, Ill.

MANHOLE COVERS (See Catch Basins)

METAL LATH. (See "Lath")

METAL ROOFING (See "Roofing)

METER BOXES
*Columbian Iron Works, Chattanooga, Tenn.
*Ford Meter Box Co., Wabash, Ind.
*Mueller Mfg. Co., H., Decatur, Ill.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
McNutt Meter Box Co., Brazil, Ind.
S. E. T. Valve & Hydrant Co., New York.

METER COUPLINGS
*Ford Meter Box Co., Wabash, Ind.
*Mueller Mfg. Co., H., Decatur, Ill.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
*Union Water Meter Co., Worcester, Mass.
Clark Co., H. W., Mattoon, Ill.
McNutt Meter Box Co., Brazil, Ind.

METER TESTERS
*Buffalo Meter Co., Buffalo, N. Y.
*Ford Meter Box Co., Wabash, Ind.
*Mueller Mfg. Co., H., Decatur, Ill.
*National Meter Co., New York.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
Clark Co., H. W., Mattoon, Ill.

** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

"PIONEER"

HIGHEST QUALITY ASPHALTS

Any Melting Point ***Any Ductility*** **Any Penetration**

PIONEER Mexican Asphalts and Compounds are different: less susceptible to heat and cold, and will comply with the strictest ductility requirements.

"PIONEER"

RUBEROAD CEMENT

It's New **It's Different** **It's Efficient**

It sticks to concrete like molasses sticks to the fingers. It acts like liquid rubber and will last longer.

THE PIONEER ASPHALT CO., **Lawrenceville, Ill.**

Buffalo-Pitts and Kelly-Springfield Rollers—Steam and Motor

All Types and Sizes

With or without Scarifier attachment.

Helps you finish the job on time.

No breakdowns—no trouble.

Send for catalog A for complete information.

THE BUFFALO-SPRINGFIELD ROLLER CO.

SPRINGFIELD -:- OHIO

METERS, WATER
*Badger Meter Mfg. Co., Milwaukee, Wis.
*Builders Iron Fdry., Providence, R. I.
*Buffalo Meter Co., Buffalo, New York.
*Hersey Mfg. Co., Boston, Mass.
*National Meter Co., New York.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
*Simplex Valve & Meter Co., Philadelphia, Pa.
*Thomson Meter Co., Brooklyn, N. Y.
Gamon Meter Co., Newark, N. J.
Worthington Pump & Mchy. Corp., New York.

MIXERS, CONCRETE. (See Concrete Mixers.)

MIXERS, GROUT
American Cement Mchy. Co., Keokuk, Ia.
Kent Machine Co., Kent, O.
Lakewood Engineering Co., Cleveland, O.
Union Iron Works, Inc., Hoboken, N. J.

MIXERS, HOT
*Austin Machinery Corp'n., Chicago, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
Kent Machine Co., Kent, O.

MIXERS, MORTAR
*Austin Machinery Corp'n., Chicago, Ill.
*Knickerbocker Co., Jackson, Mich.
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Standard Scale & Supply Co., Pittsburgh, Pa.
American Cement Machine Co., Keokuk, Ia.
Blaw-Knox Co., Pittsburgh, Pa.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Construction Machinery Co., Waterloo, Ia.
Kent Machine Co., Kent, O.
Lansing Co., Lansing, Mich.
Lakewood Engineering Co., Cleveland, Ohio.
Smith Co., T. L., Milwaukee, Wis.

MOTORS, ELECTRIC
*Allis Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Crocker-Wheeler Co., Ampere, N. J.
Lincoln Electric Co., Cleveland, Ohio.
Robbins & Myers Co., Springfield, O.
Triumph Electric Co., Cincinnati, O.
Wagner Elec. Mfg. Co., St. Louis, Mo.

MOTOR FIRE APPARATUS
Ahrens-Fox Fire Engine Co., Cincinnati, O.
American-La France Fire Eng. Co., Elmira, N. Y.
Childs Co., O. J., Utica, N. Y.
Prospect Mfg. Co., Prospect, O.
Seagrave Co., Columbus, O.
Stutz Fire Engine Co., Indianapolis, Ind.

MOTOR TRUCKS
*Federal Motor Truck Co., Detroit, Mich.
*General Motors Truck Co., Pontiac, Mich.
*International Motor Co., New York.
*Packard Motor Car Co., Detroit, Mich.
*Tiffin Wagon Co., Tiffin, O.
*White Co., Cleveland, Ohio.
*Winther Motor Truck Co., Kenosha, Wis.
Acason Motor Truck Co., Detroit, Mich.
Acme Motor Truck Co., Cadillac, Mich.
All American Truck Co., Chicago, Ill.
Atterbury Motor Car Co., Buffalo, N. Y.
Autocar Co., Ardmore, Pa.
Bessemer Motor Truck Co., Grove City, Pa.
Brockway Motor Truck Co., Cortland, N. Y.
Clydesdale Motor Truck Co., Clyde, O.
Corbitt Motor Truck Co., Henderson, No. Car.
Denby Motor Truck Co., Detroit, Mich.
Diamond T. Motor Car Co., Chicago, Ill.
Duplex Truck Co., Lansing, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Garford Motor Truck Co., Lima, O.
Gary Motor Truck Co., Gary, Ind.
Gramm Bernstein Motor Truck Co., Lima, O.
Indiana Truck Corp'n., Marion, Ind.
Jackson Motors Corp'n., Jackson, Mich.
Kelly Springfield Motor Truck Co., Springfield, O
Kissel Motor Car Co., Hartford, Wis.
Larrabee-Deyo Motor Truck Co., Binghamton, N. Y.
Nash Motors Co., Kenosha, Wis.
Nelson Motor Truck Co., Saginaw, Mich.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Republic Motor Truck Co., Alma, Mich.
Selden Truck Corp'n., Co., Wabash, Ind.
Service Motor Truck Co., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Stewart Motor Corp'n., Buffalo, N. Y.
Titan Motor Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Transport Truck Co., Mt. Pleasant, Mich.
U. S. Motor Truck Co., Cincinnati, O.
Velie Motors Corpn., Moline, Ill.
Ward LaFrance Truck Co., Elmira, N. Y.
Watson Products Corp'n., Canastota, N. Y.
Wilson Co., J. C., Detroit, Mich.

MOULDS, CONCRETE
Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.

OAKUM
Wall Rope Works, Beverly, N .J.

OIL, ROAD
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Standard Oil Co. of Indiana, Chicago, Ill.
*Texas Company, New York.
Atlantic Refining Co., Philadelphia, Pa.
Headley Good Roads Co., Philadelphia, Pa.
Pierce Oil Corp., New York.
Sinclair Refining Co., Chicago, Ill.
Standard Oil Co., (La.) New Orleans, La.
Standard Oil Co., (N. J.) Newark, N. J.
U. S. Asphalt Refining Co., New York.

PACKING, WATER PIPE
*Leadite Co., The, Philadelphia, Pa.
*Union Water Meter Co., Worcester, Mass.
*United Lead Company, New York.

PAINTS, METAL PROTECTION
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Acme White Ld. & Col. Works, Detroit, Mich.
Berry Bros., Detroit, Mich.
Cook Paint Co., Kansas City, Mo.
Detroit Graphite Co., Detroit, Mich.
Detroit White Lead Wks., Detroit, Mich.
Dixon Crucible Co., Jos., Jersey City, N .J.
Longman & Martinez, New York.
Martin-Senour Co., Chicago, Ill.
Minwax Co., New York.
Protexol Corpn., New York.
Ruberoid Co., New York.
Semet-Solvay Co., Syracuse, N. Y.
Sherwin-Williams Co., Cleveland, O.
Sonneborn Sons, Inc., L., New York.
Toch Bros., New York.

PAPERS, BLUE PRINT AND BROWN PRINT
Indianapolis Blue Print & Supply Co., Indianapolis, Ind.

PAPER, BUILDING, ROOFING, ETC.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, O.
Bird & Son, E. Walpole, Mass.
Brown Co., Portland, Me.
Hydrex Felt & Eng. Co., New York.
Johns-Manville, Inc., New York.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.

PAVING AND ROAD ROLLERS (See Road and Paving Rollers)

PAVING BLOCKS, CREOSOTED WOOD
*Republic Creosoting Co., Youngstown, O.
American Creosote Wks., Inc., New Orleans, La.
Jennison-Wright Co., Toledo, O.
Protexol Corpn., New York.

PAVING BRICK
*Metropolitan Paving Brick Co., Canton, O.
Alton Brick Co., Alton, Ill.
Barr Clay Co., Streator, Ill.
Burton Townsend Co., Zanesville, O.
Flint Brick Co., Des Moines, Ia.
Hydraulic Press Brick Co., St. Louis, Mo.
McAvoy Vit. Brick Co., Philadelphia, Pa.
Mack Mfg. Co., Wheeling, W. Va.
Mayer Brick Co., C. P., Bridgeville, Pa.
Medal Paving Brick Co., Cleveland, O.
Murphysboro Paving Brick Co., Murphysboro, Ill.
Patton Clay Mfg. Co., Patton, Pa.
Peebles Brick Co., Portsmouth, O.
Penna. Clay Co., Pittsburgh, Pa.
Pittsburgh Paving Brick Co., Pittsburgh, Kas.
Poston Paving Brick Co., Crawfordsville, Ind.

CAST IRON PIPE

TYPES	FOR
Bell and Spigot	Water mains
Flanged	Steam mains
Plain End	Gas mains
Flexible Joint	Submarine lines

FITTINGS

Bell and Spigot	Water
Flanged	Steam
Special	Gas and Oil

CASTINGS

Chemical	Hydraulic
Sugar House	Machinery
Semi-steel	Railroad

Send for descriptive literature.

United States Cast Iron Pipe & Foundry Co.

General Office, Burlington, New Jersey

Sales Offices:

Philadelphia, 1421 Chestnut St.
Chicago, 122 So. Michigan Blvd.
San Francisco, Monadnock Bldg.
Dallas, Tex. Scollard Bldg.
Pittsburgh, Henry W. Oliver Bldg.
St. Louis, Security Bldg.
New York, 71 Broadway.
Birmingham, Ala., American Trust Bldg.
Buffalo, 957 E. Ferry St.
Cleveland, 1150 E. 26th St.
Minneapolis, Plymouth Bldg.

Purington Paving Brick Co., Galesburg, Ill.
Southern Clay Mfg. Co., Chattanooga, Tenn.
Sterling Brick Co., Olean, N. Y.
Thurber Brick Co., Thurber, Texas.
Veedersburg Paver Co., Veedersburg, Ind.

PAVING MACHINERY
***Austin Mach. Corp., Chicago, Ill.**
***Austin-Western Road Mchy. Co., Chicago, Ill.**
***Barber Asphalt Paving Co., Philadelphia, Pa.**
***Buffalo-Springfield Roller Co., Springfield, O.**
***Equitable Asphalt Main. Co., Kansas City, Mo.**
***Erie Machine Shops, Erie, Pa.**
***Koehring Machine Co., Milwaukee, Wis.**
Atlas Engineering Co., Milwaukee, Wis.
Badger Concrete Mixer Co., Milwaukee, Wis.
Construction Machinery Co., Waterloo, Ia.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, O.
Judy Mfg. Co., Centerville, Ia.
Lakewood Engineering Co., Cleveland, O.

PAVING MATERIALS (See "Asphalt," "Paving Brick," "Granite Block," etc.)

PAVING MIXERS. (See Concrete Mixers)

PAVING TOOLS
***Barber Asphalt Paving Co., Philadelphia, Pa.**
***Littleford Bros. Co., Cincinnati, O.**
***Warren Bros. Co., Boston, Mass.**
Anderson Tool & Sup. Co., W. H., Detroit, Mich.
Connery & Co., Inc., Philadelphia, Pa.
Kramer Bros. Fdry. Co., Dayton, O.
Union Iron Works, Hoboken, N. J.

PERFORATED METALS
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**

PICKS
Hubbard Co., Pittsburgh, Pa.
Iron City Tool Works, Pittsburgh, Pa.
Klein-Logan Co., Pittsburgh, Pa.
Verona Tool Works, Verona, Pa.
Warren Tool & Forge Co., Warren, O.
Warwood Tool Co., Wheeling, W. Va.

PILE DRIVERS
***McKiernan-Terry Drill Co., New York.**
Browning Co., Cleveland, O.
Clyde Iron Works, Duluth, Minn.
Industrial Works, Bay City, Mich.
Lidgerwood Manufacturing Co., New York.
McMyler Interstate Co., Cleveland, O.
Union Iron Works, Hoboken, N. J.

PILE HAMMERS, STEAM
***McKiernan-Terry Drill Co., New York.**
*National Hoisting Eng. Co., Harrison, N. J.
Clyde Iron Works, Duluth, Minn.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Chicago, Ill.

PILING, INTERLOCKING STEEL
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

PIPE, CAST IRON
***American Cast Iron Pipe Co., Birmingham, Ala.**
***Central Foundry Co., New York.**
***Lynchburg Fdry. Co., Lynchburg, Va.**
***U. S. Cast Iron Pipe & Fdy. Co., Burlington, N.J.**
***Warren Fdry. & Machine Co., New York.**
***Wood & Co., R. D., Philadelphia, Pa.**
Clow & Sons, J. B., Chicago, Ill.
Fox & Co., John, New York.
Glamorgan Pipe & Fdry. Co., Lynchburg, Va.
National Cast Iron Pipe Co., Birmingham, Ala.

PIPE, CORR. METAL.
***Good Roads Mach'y Co., Philadelphia, Pa.**
***Newport Culvert Co., Newport, Ky.**
Canton Culvert & Silo Co., Canton, O.
Hardesty Mfg. Co., Denver, Col.

PIPE, LEAD
***United Lead Company, New York.**

PIPE, REINFORCED CONCRETE
Lock Joint Pipe Co., E. Orange, N. J.
Massey Concrete Products Corp'n, Chicago, Ill.

PIPE, RIVETED STEEL
***Chicago Bridge & Iron Works, Chicago, Ill**
***East Jersey Pipe Co., New York.**
*Honhorst Co., Jos., Cincinnati, Ohio.
***Littleford Bros. Cincinnati, Ohio.**
***Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.**
Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Spiral Pipe Works, Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.
Canton Culvert & Silo Co., Canton, O.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Connery & Co., Inc., Philadelphia, Pa.
Hammond Iron Works, Warren, Pa.
Hardesty Mfg. Co., R., Denver, Col.
Lancaster Iron Works, Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Tippet & Wood, Phillipsburg, N. J.

PIPE, SPIRAL RIVETED
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Abendroth & Root Mfg. Co., Newburgh, N. Y
American Spiral Pipe Works, Chicago, Ill.

PIPE STEEL
***East Jersey Pipe Co., New York.**
National Tube Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, WOOD
***American Wood Pipe Co., Tacoma, Wash.**
***Continental Pipe Mfg. Co., Seattle, Wash.**
*Pacific Tank & Pipe Co., San Francisco, Cal.
***Redwood Mfrs. Co., San Francisco, Cal.**
Michigan Pipe Co., Bay City, Mich.
Standard Wood Pipe Co., Williamsport, Pa.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE, WROUGHT IRON
Byers Co., A. M., Pittsburgh, Pa.
Reading Iron Co., Reading, Pa.

PIPE COVERING
***Carey Co., Philip, Cincinnati, O.**
***Continental Pipe Mfg. Co., Seattle, Wash.**
***Redwood Mfrs. Co., San Francisco, Cal.**
Johns-Manville, Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.
Michigan Pipe Co., Bay City, Mich.
Pacific Tank & Pipe Co., San Francisco, Cal.
Standard Wood Pipe Co., Williamsport, Pa.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE CUTTERS. (See Cutters, Pipe, Hand.)

PIPE FITTINGS
***American C. I. Pipe Co., Birmingham, Ala.**
***Builders Iron Fdry, Providence, R. I.**
***Central Foundry Co., New York.**
***Crane Co., Chicago, Ill.**
***U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.**
***Warren Fdry. and Mach. Co., New York.**
Clow & Sons, J. B., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Wood & Co., R. D., Philadelphia, Pa.

PIPE HANDLING MACHINERY
***Mueller Mfg. Co., H., Decatur, Ill.**
Taylor Portable Steel Derrick Co., Chicago, Ill.

PIPE JOINT COMPOUND, SEWER
***Carey Co., Philip, Cincinnati, O.**
***Leadite Company, Inc., Philadelphia, Pa.**
***Pacific Flush Tank Co., Chicago, Ill.**
***Waring-Underwood Co., Philadelphia, Pa.**
Dixon Crucible Co., J., Jersey City, N. J.
Ruberoid Co., New York.

PIPE JOINT MATERIAL, CAST IRON
***Leadite Co., The, Philadelphia, Pa.**
***United Lead Co., New York.**
Lead-Hydro-Tite Co., Boston, Mass.

PLOWS, CONTRACTORS
***Burch Plow Works Co., Crestline, O.**
***Holt Mfg. Co., Peoria, Ill.**
*Marion Steam Shovel Co., Marion, O.
***Russell Grader Mfg. Co., Minneapolis, Minn.**
American Steel Scraper Co., Sidney, O.
Case Threshing Machine Co., J. I., Racine Wis.
Deere & Co., Moline, Ill.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
International Harvester Co., Chicago, Ill.
Moline Plow Co., Moline, Ill.
Oliver Chilled Plow Works, South Bend, Ind.
Sidney Steel Scraper Co., Sidney, O.
Western Wheeled Scraper Co., Aurora, Ill.
Wiard Plow Co., Batavia, N. Y.

** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

PATENT COMBINATION
Auto Heater and Distributor

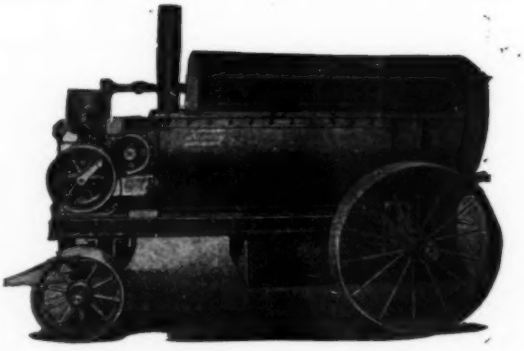
QUALITY
Kinney
EFFICIENCY

HANDY HEATER and SPRAYER

Especially adapted for Road maintenance, construction and general repair work. Contents constantly agitated while heating.

No burning or coking of material. Pump, Piping, Hose, Nozzles, Automatically Heated.

No Steam Required.



Kinney Manufacturing Company

3529 Washington Street
BOSTON, MASSACHUSETTS

BRANCHES:

NEW YORK PHILADELPHIA CHICAGO SAN FRANCISCO HOUSTON KANSAS CITY

PLUMBING SUPPLIES
***Mueller Mfg. Co., H., Decatur, Ill.**
Clow & Sons, J. B., Chicago, Ill.
Glauber Brass Mfg. Co., Cleveland, O.
Rundle-Spence Mfg. Co., Milwaukee, Wis.
United Brass Mfg. Co., Cleveland, O.
Walworth Mfg. Co., Boston, Mass.

POLES, STEEL STRUCTURAL
***Electric Railway Equipment Co., Cincinnati, O.**
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Blaw-Knox Co., Pittsburgh, Pa.

PORTABLE BUILDINGS
*Littleford Bros., Cincinnati, Ohio.
***Truscon Steel Co., Youngstown, O.**
Blaw-Knox Co., Pittsburgh, Pa.
Pruden Co., C. D., Baltimore, Md.

PORTABLE STEEL DERRICKS. (See Derricks, Steel Portable.)

PORTLAND CEMENT. (See Cement.)

POWDER. (See Explosives.)

PUMPS, AIR LIFT
***Indiana Air Pump Co., Indianapolis, Ind.**
Advance Pump & Compr. Co., Battle Creek, Mich.
American Steam Pump Co., Battle Creek, Mich.
Cameron Steam Pump Works, A. S., New York.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.
Union Steam Pump Co., Battle Creek, Mich
Worthington Pump & Mchy. Corp., New York.

PUMPS, BOILER FEED
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***Dayton-Dowd Co., Quincy, Ill.**
***De Laval Steam Turbine Co., E. Trenton, N. J.**
***Fairbanks, Morse & Co., Chicago, Ill.**
***Indiana Air Pump Co., Indianapolis, Ind.**
***Lea-Courtenay Co., Newark, N. J.**
***Midwest Engine Co., Indianapolis, Ind.**
Advance Pump & Compr. Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Works, A. S., New York.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Deming Co., Salem, O.
Gardner Governor Co., Quincy, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Scranton Pump Co., Scranton, Pa.
Vogt Bros. Mfg. Co., Louisville, Ky.
Warren Steam Pump Co., Warren, Mass.
Weinman Pump Mfg. Co., Columbus, O.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***American Well Works, Aurora, Ill.**
***Dayton-Dowd Co., Quincy, Ill.**
***Delaval Steam Turbine Co., Trenton, N. J.**
***Fairbanks, Morse & Co., Chicago, Ill.**
***Indiana Air Pump Co., Indianapolis, Ind.**
***Lea-Courtenay Co., Newark, N. J.**
***Midwest Engine Co., Indianapolis, Ind.**
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Camden Iron Works, Camden, N. J.
Cameron Steam Pump Works, A. S., New York.
Clark Co., H. W., Mattoon, Ill.
Domestic Eng. & Pump Co., Shippensburg, Pa.
Erie Pump & Engine Works, Medina, N. Y.
Goulds Mfg. Co., Seneca Falls, N. Y.
Keystone Driller Co., Beaver Falls, Pa.
Manistee Iron Wks., Manistee, Mich.
Morris Machine Works, Baldwinsville, N. Y.
Schramm & Son, Inc., Chris. D., Philadelphia, Pa.
United Iron Works, Kansas City, Mo.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mchy. Corp., New York.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CONTRACTORS'
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***American Well Works, Aurora, Ill.**
***Dayton-Dowd Co., Quincy, Ill.**
***Fairbanks, Morse & Co., Chicago, Ill.**
***Lea-Courtenay Co., Newark, N. J.**
***Midwest Engine Co., Indianapolis, Ind.**
***Novo Engine Co., Lansing, Mich.**
***Standard Scale & Supply Co., Pittsburgh, Pa.**
***Waldo Bros. & Bond Co., Boston, Mass.**
Barnes Mfg. Co., Mansfield, O.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Cameron Steam Pump Works, A. S., New York.
Construction Mach'y Co., Waterloo, Ia.
Deming Co., Salem, Ohio.
Domestic Engine & Pump Co., Shippensburg, Pa.
Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Works, Medina, N. Y.
Goulds Mfg. Co., Seneca Falls, N. Y.
McGowan Co., J. H., Cincinnati, O.
Morris Machine Works, Baldwinsville, N. Y.
New York Eng. Co., New York.
Pulsometer Steam Pump Co., New York.
Schramm & Son, Inc., Chris. D., Philadelphia, Pa
Smith Co., T. L., Milwaukee, Wis.
Universal Motor Co., Oshkosh, Wis.
Van Nouhuys Machine Wks., Albany, N. Y.

PUMPS, DEEP WELL
*American Well Works, Aurora, Ill.
***Cook, A. D., Lawrenceburg, Ind.**
***Fairbanks, Morse & Co., Chicago, Ill.**
***Indiana Air Pump Co., Indianapolis, Ind.**
***Midwest Engine Co., Indianapolis, Ind.**
***Nordberg Mfg. Co., Milwaukee, Wis.**
***United Iron Works, Kansas City, Mo.**
Aldrich Pump Co., Allentown, Pa.
Cameron Steam Pump Works, A. S., New York.
Clark Co., H. W., Mattoon, Ill.
Deming Co., Salem, O.
Goulds Mfg. Co., Seneca Falls, N. Y.
Keystone Driller Co., Beaver Falls, Pa.
Layne & Bowler Co., Memphis, Tenn.
Weber Subterranean Pump Co., New York.

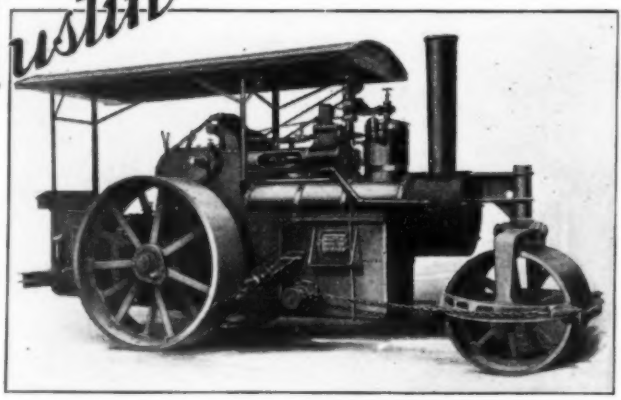
PUMPS, DREDGING
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
*American Well Works, Aurora, Ill.
Aldrich Pump Co., Allentown, Pa.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Wks., A. S., New York.
Domestic Eng. & Pump Co., Shippensburg, Pa.
Morris Machine Works, Baldwinsville, N. Y.
Ramsey Pump Co., Ltd., Seneca Falls, N. Y.
Wood & Co., R. D., Philadelphia, Pa.
Worthington Pump & Mchy. Corp., New York.

PUMPS, GASOLINE AND OIL
***Kinney Mfg. Co., Boston, Mass.**
Bowser & Co., S. F., Fort Wayne, Ind.
Worthington Pump & Mach. Corp., New York.

PUMPS, POWER
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***Dayton-Dowd Co., Quincy, Ill.**
***De Laval Steam Turbine Co., Trenton, N. J.**
***Fairbanks, Morse & Co., Chicago, Ill.**
***Indiana Air Pump Co., Indianapolis, Ind.**
***Kinney Mfg. Co., Boston, Mass.**
***Koehring Machine Co., Milwaukee, Wis.**
***Lea-Courtenay Co., Newark, N. J.**
***Midwest Engine Co., Indianapolis, Ind.**
***Nordberg Mfg. Co., Milwaukee, Wis.**
***Northern Fire Apparatus Co., Minneapolis, Minn.**
***United Lead Company, New York.**
Alamo Iron Works, San Antonio, Tex.
American Steam Pump Co., Battle Creek, Mich.
American Well Works, Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Cameron Steam Pump Works, A. S., New York.
Deming Co., Salem, O.
Domestic Eng. & Pump Co., Shippensburg, Pa.
Gardner Governor Co., Quincy, Ill.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Goulds Mfg. Co., Seneca Falls, N. Y.
Ingersoll-Rand Co., New York.
Lawrence Machine Co., Lawrence, Mass.
McGowan Co., J. H., Cincinnati, O.
Morris Machine Works, Baldwinsville, N. Y.
Weinman Pump Mfg. Co., Columbus, O.
Worthington Pump & Machy. Corp., New York.
Yeomans Bros. Co., Chicago, Ill.

RAILS AND RAIL JOINTS
Bethlehem Steel Co., Bethlehem, Pa.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Easton Car & Constn. Co., New York.
Hirsch Rolling Mill Co., St. Louis, Mo.
Lackawanna Steel Co., Buffalo, N. Y.
Sweet's Steel Co., Williamsport, Pa.
Zelnicker Supply Co., W., St. Louis, Mo.

Austin



100% Dividends

in Service and Satisfaction

Austin Rollers haven't joined the ranks of the investments that pass dividends in hard times and they never will.

On the job every minute and staying there for years, they are a sure source of constant satisfaction and profit to contractor or public official.

An Austin Roller is better than the best bond on earth as a guarantee that your work will be done on time and done right.

Three-wheeled Rollers in two types—Motor and Steam—with or without Scarifier Attachment—and in five sizes. Satisfy all requirements and suit all tastes.

Four sizes of Tandem Rollers, but only the Motor type which has proved itself so far ahead of steam that we wouldn't have the nerve to sell anything else.

Your copy of the New Austin Roller Catalog, just off the press, will be on its way within an hour of the time your request reaches us.

It's worth asking for.

The Austin-Western Road Machinery Co.

CHICAGO

Albany
Atlanta
Billings
Columbus
Dallas
Boston
Denver
Jackson
Los Angeles
Nashville
New Orleans
New York City
Oklahoma City
Philadelphia
Pittsburgh
Portland
Richmond
St. Paul
San Francisco
Salt Lake City
Topeka
Wahoo

EXPORT DEPARTMENT
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA

RAILROAD DITCHERS
*Austin Machinery Corp'n., Chicago, Ill.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Marion Steam Shovel Co., Marion, O.
*Thew Shovel Co., Lorain, O.
American Hoist & Derrick Co., St. Paul, Minn.
Ball Engine Co., Erie, Pa.
Buckeye Traction Ditcher Co., Findlay, O.
Byers Machine Co., J. F., Ravenna, O.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.

RECORDERS, WATER STAGE
*Builders Iron Fdry., Providence, R. I.
Gurley, W. & L. E., Troy, N. Y.

REINFORCING CONCRETE. (See Concrete Reinforcements.)

RIVETERS, PNEUMATIC
Alliance Machine Co., Alliance, O.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Hanna Eng. Works, Chicago, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Watson-Stillman Co., New York.

RIVETS, BRIDGE AND STRUCTURAL. (See Bolts, Nuts, Etc.)

ROAD OILS. (See Oils, Road.)

ROAD OILERS
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Machinery Co., Philadelphia, Pa.
*Kinney Mfg. Co., Boston, Mass.
*Littleford Bros., Cincinnati, Ohio.
*Universal Road Mchy. Co., Kingston, N. Y.
*White Co., Cleveland, O.
Autocar Co., Ardmore, Pa.
Etnyre & Co., E. D., Oregon, Ill.
Four Wheel Drive Auto Co., Clintonville, Wis.
Huber Mfg. Co., Marion, O.
Selden Truck Corp'n., Co., Wabash, Ind.
Service Motor Truck Co., Wabash, Ind.

ROAD AND PAVING ROLLERS
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Good Roads Machinery Co., Philadelphia, Pa.
Case Threshing Machine Co., J. I., Racine, Wis.
Erie Machine Shops, Erie, Pa.

ROAD AND STREET MACHINERY
*Acme Road Machinery Co., Frankfort, N. Y.
*Austin Machinery Corp'n., Chicago, Ill.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co. Springfield, O.
*Good Roads Machinery Co., Philadelphia, Pa.
*Holt Mfg. Co., Peoria, Ill.
*Kinney Mfg. Co., Boston, Mass.
*Koehring Machine Co., Milwaukee, Wis.
*Koppel Ind. Car & Equipment Co., Koppel, Pa.
*Littleford Bros., Cincinnati, O.
*Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Universal Road Mchy. Co., Kingston, N. Y.
Adams & Co., J. D., Indianapolis, Ind.
Aultman & Taylor Mach. Co., Mansfield, Ohio.
Avery Co., Peoria, Ill.
Connery & Co., Inc., Philadelphia, Pa.
Erie Machine Shops, Erie, Pa.
Galion Iron Wks. & Mfg. Co., Galion, Ohio.
Haiss Mfg. Co., Geo., New York.
Honhorst Co., Jos., Cincinnati, O.
Lakewood Engineering Co., Cleveland, O.
Smith & Sons Mfg. Co., Kansas City, Mo.
Smith Co., T. L., Milwaukee, Wis.
United Iron Works, Kansas City, Mo.

ROCK CRUSHERS AND PULVERIZERS
*Acme Road Machinery Co., Frankfort, N. Y.
*Allis-Chalmers Mfg. Co. Milwaukee, Wis.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Machinery Co., Philadelphia, Pa.
*Universal Road Machinery Co., Kingston, N. Y.
Chalmers & Williams, Inc., Chicago Heights, Ill.
Fuller Lehigh Co., Fullerton, Pa.
Galion Iron Works Mfg. Co., Galion, O.
Guendler Pat. Crusher & Pulv. Co., St. Louis, Mo.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Co., Philadelphia, Pa.
McLanahan-Stone Mchy. Co., Hollidaysburg, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill
Smith Eng. Works, Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Williams Patent Crusher & Pulv. Co., Chicago, Ill.
Worthington Pump & Machy. Corp., New York.

ROCK DRILLS. (See Drills, Rock)

ROOFING, ASPHALT, COMPOSITION, ETC.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Mfg. Co., Philip, Cincinnati, O.
*Standard Oil Co. of Indiana, Chicago, Ill.
*Texas Co., New York.
American Cement Tile Mfg. Co., Pittsburgh, Pa.
Atlantic Refining Co., Philadelphia, Pa.
Bird & Son, E. Walpole, Mass.
Edwards Mfg. Co., Cincinnati, O.
Flintkote Co., Boston, Mass.
Johns-Manville, Inc., New York.
Keystone Roofing Mfg. Co., York, Pa.
Lehon Co., The, Chicago, Ill.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.
Sall Mountain Co., Chicago, Ill.
Sifo Products Co., St. Paul, Minn.
Sonneborn & Sons, Inc., L., New York.
United States Gypsum Co., Chicago, Ill.
Western Elaterite Roofing Co., Denver, Colo.

ROOFING, METAL
*Truscon Steel Co., Youngstown, O.
American Rolling Mill Co., Middletown, Ohio.
Berger Mfg. Co., Canton, O.
Edwards Mfg. Co., Cincinnati, O.
National Metal Roofing Co., Jersey City, N. J.
Stark Rolling Mill Co., Canton, O.

ROOFING KETTLES. (See Kettles)

ROPE, MANILA
American Mfg. Co., Brooklyn, New York.
Columbian Rope Co., Auburn, N. Y.
Cupples Cordage Co., Brooklyn, N. Y.
Hooven & Allison Co., Xenia, O.
Kelly Co., R. A., Xenia, O.
New Bedford Cordage Co., New Bedford, Mass.
Peoria Cordage Co., Peoria, Ill.
Plymouth Cordage Co., N. Plymouth, Mass.
Wall Rope Wks., New York.
Waterbury Co., New York.
Whitlock Cordage Co., New York.

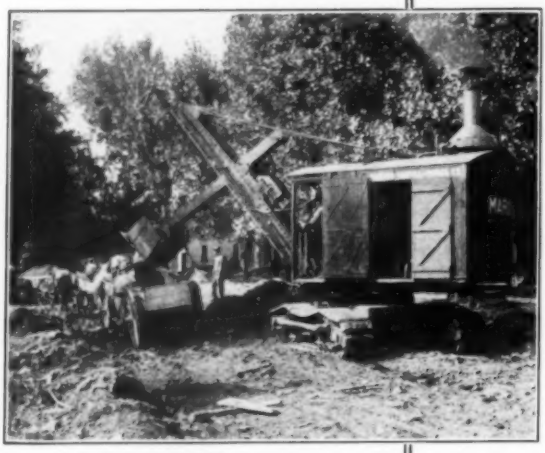
ROPE, WIRE, HOISTING, HAULAGE
American Steel & Wire Co., Chicago, Ill.
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.
MacWhyte Co., Kenosha, Wis.
Moon Co., Geo. C., Garwood, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York.
Wickwire Spencer Steel Corp., Worcester, Mass.
Williamsport Wire Rope Co., Williamsport, Pa.

RULES, FOLDING
Kolesch & Co., N. Y. C.
Lufkin Rule Co., Saginaw, Mich.

SASH, ROLLED STEEL. (See Window Frames and Sash)

SAW RIGS, PORTABLE
*Knickerbocker Co., Jackson, Mich.
*Ransome Concrete Mach. Co., Dunnellen, N. J.
*Standard Scale & Supply Co., Pittsburgh, Pa.
C. H. & E. Mfg. Co., Milwaukee Wis.
Oshkosh Mfg. Co., Oshkosh, Wis.

SCARIFIERS
*Acme Road Machy. Co., Frankfort, N. Y.
*Austin Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Good Roads Machinery Co., Philadelphia, Pa.
*Lyle Cul. & Rd. Equip. Co., Minneapolis, Minn.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Universal Road Mchy. Co., Kingston, N. Y.
Adams & Co., J. D., Indianapolis, Ind.
Galion Iron Works & Mfg. Co., Galion, O.
Huber Mfg. Co., Marion, O.



Contractors want the shovel that will dig the most dirt in the least possible time. The Marion "21" with its inbuilt ruggedness and its ease of handling will keep the wagons or trucks loaded and on the move—demonstrating Marion *quality* and *dependability* through *service*.

The model 21 has a prominent place in our production schedule. It can be furnished with steam, gasoline or electric power.

We will take pleasure in serving you, if you'll give us your requirements.

The Marion Steam Shovel Co.
Marion, Ohio

NEW YORK CHICAGO ATLANTA SAN FRANCISCO

BUCYRUS STEAM SHOVELS

Are built with the speed, ruggedness and power that assures profit on your job—if you also have crane work, sewer excavation and dragline work to do, you can find a Bucyrus that will fill your bill.

Send for Bulletin C-G (340)

BUCYRUS COMPANY
South Milwaukee, Wisconsin.

Performance

"This" said a well known contractor the other day, "is the toughest job I ever tackled."

The soil was heavy blue clay with boulders packed in. The contractor had just finished a footing 21' deep when he passed the above remark.

This man is an enthusiast. You would be too if you had a shovel that could deliver as consistently and economically as his Thew. Why not?

THE THEW SHOVEL CO.
LORAIN, OHIO

Thew
Power Shovels

SCRAPERS, ROAD
*Acme Road Machy. Co., Frankfort, N. Y.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, O.
*Good Roads Machinery Co., Philadelphia, Pa.
*Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
*Russell Grader Co., Minneapolis, Minn.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Machine Co., J. I., Racine, Wis.
East Iron & Machine Co., Lima, O.
Gallion Iron Works & Mfg. Co., Gallion, O.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Root Spring Scraper Co., Kalamazoo, Mich.
Sidney Steel Scraper Co., Sidney, O.
Western Wheeled Scraper Co., Aurora, Ill.

SCRAPERS, SELF-LOADING
*Baker Manufacturing Co., Springfield, Ill.
Smith & Sons Mfg. Co., Kansas City, Mo.

SCREENS, SAND, GRAVEL AND COAL
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Littleford Bros., Cincinnati, O.
*Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Bartlett & Snow Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Philadelphia, Pa.
New Jersey Wire Cloth Co., Trenton, N. J.
Robins Conv. Belt Co., N. Y. C.
Sackett Screen & Chute Co., H. B., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Wickwire Spencer Steel Corp., Worcester, Mass.

SCREENS, SEWAGE
*Pacific Flush Tank Co., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.

SCREWS
American Screw Co., Providence, R. I.
Clark Bros. Belt Co., Milldale, Conn.
St. Louis Screw Co., St. Louis, Mo.

SECOND-HAND EQUIPMENT
*Briggs, Inc., Marvin, Bkn., New York.
*Contractors Mach. & Supply Co., Pittsburgh, Pa.
*Craven Co., Frank T., New York.
*Curtiss-Willis Co., New York.
*Forsythe Bros., New York.
*Grey Steel Prod. Co., New York.
*King, Philip T., New York, N. Y.

SEWAGE DISPOSAL APPARATUS
*Derr Co., The, New York City.
*Pacific Flush Tank Co., Chicago, Ill.

SEWAGE PUMPS AND EJECTORS
*Ottersen Auto Eductor Co., Springfield, O.
*Pacific Flush Tank Co., Chicago, Ill.
Erie Pump & Eng. Works, Medina, N. Y.
Walworth Mfg. Co., Boston, Mass.
Yeomans Bros. Co., Chicago, Ill.

SEWER BLOCKS, SEGMENT
American Vit. Products Co., Akron, O.
Denver Sewer Pipe & Clay Co., Denver, Col.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Macomb Sewer Pipe Wks., Macomb, Ill.
McNutt Meter Box Co., Brazil, Ind.
Red Wing Sewer Pipe Co., Red Wing, Minn.

SEWER CLEANING APPARATUS
*Healey, P. J., New York.
*Thompson-Fleming Co., Inc., Buffalo, N. Y.
*Turbine Sewer Machine Co., Milwaukee, Wis.
Champion Corporation, Hammond, Ind.

SEWER PIPE AND DRAIN TILE
*Dee Co., Wm. E., Chicago, Ill.
*Delaware Clay Products Co., Pittsburgh, Pa.
American Vit. Products Co., Akron, O.
Blackmer & Post Pipe Co., St. Louis, Mo.
Denver Sewer Pipe & Clay Co., Denver, Col.
National Fireproofing Co., Pittsburgh, Pa.
Robinson Clay Product Co., Akron, O.

SEWER RODS
*Turbine Sewer Machine Co., Milwaukee, Wis.
Bissell Co., F., Toledo, O.
Champion Corporation, Hammond, Ind.

SHOVELS, ELECTRIC
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Thew Shovel Co., Lorain, O.

SHOVELS, GASOLINE
*Austin Mach. Corp. Chicago, Ill.
*Marion Steam Shovel Co., Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Thew Shovel Co., Lorain, O.
American Steel Dredge Co., Fort Wayne, Ind.
Fairbanks Steam Shovel Co., Marion, O.

SHOVELS, HAND
American Shovel & Stamping Co., Lorain, O.
Ames Shovel & Tool Co., Boston, Mass.
Chisholm Shovel Co., Cleveland, O.
Conneaut Shovel Co., Conneaut, O.
Hubbard & Co., Pittsburgh, Pa.
Indiana Shovel Co., New Castle, Ind.
Pittsburgh Shovel Co., Pittsburgh, Pa.
Wood Shovel & Tool Co., Piqua, Ohio.
Wyoming Shovel Works, Wyoming, Pa.

SHOVELS, STEAM
*Austin Mach. Corp. Chicago, Ill.
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Thew Shovel Co., Lorain, O.
American Steel Dredge Co., Fort Wayne, Ind.
Ball Engine Co., Erie, Pa.
Bellwood Steam Shovel Co., Bellwood, Pa.
Browning Co., Cleveland, O.
Byers Machine Co., J. F., Ravenna, O.
Fairbanks Steam Shovel Co., Marion, O.
Industrial Works, Bay City, Mich.
Keystone Driller Co., Beaver Falls, Pa.
Osgood Co., Marion, O.
Smith Co., T. L., Milwaukee, Wis.

SIGNS, STREET AND ROAD
*Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
*Thompson-Fleming Co., Inc., Buffalo, N. Y.
Baltimore Enamel & Novelty Co., Baltimore, Md.
Ingram-Richardson Mfg. Co., Beaver Falls, Pa.
N. Y. Enameled Steel Sign Co., New York.
Union Iron Products Co., East Chicago, Ind.

SLEEVES, TAPPING AND VALVE
*Mueller Mfg. Co., Decatur, Ill.
*Rensselaer Valve Co., Troy, N. Y.
*Smith Mfg. Co., A. P., East Orange, N. J.

SLUICE GATES. (See Gates, Sluice.)

SNOW CLEANING MACHINERY
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Cleveland Tractor Co., Cleveland, O.
*Good Roads Machinery Co., Philadelphia, Pa.
*Holt Mfg. Co., Peoria, Ill.
Toy Co., W. M., Sidney, Ohio.
J. T. Tractor Co., Cleveland, O.
Owensboro Ditcher & Grader Co., Owensboro, Ky.

SPREADERS, STONE
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Burch Plow Works Co., Crestline, O.

STACKS, STEEL
*Chicago Bridge & Iron Works, Chicago, Ill.
*Heil Co., The, Milwaukee, Wis.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros., Cincinnati, O.
Blaw-Knox Co., Pittsburgh, Pa.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Connery & Co., Inc., Philadelphia, Pa.
Honhorst Co., Jos., Cincinnati, O.
Petroleum Iron Works Co., Sharon, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STEAM SHOVELS. (See Shovels, Steam)

STANDPIPES, TANKS AND TOWERS
*Chicago Bridge & Iron Works, Chicago, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Pacific Tank & Pipe Co., San Francisco, Cal.
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Caldwell Co., W. E., Louisville, Ky.
Chattanooga Blr. & Tank Co., Chattanooga, Tenn.

Cletrac Cuts Road Maintenance Costs

SPECIFICATIONS

Horsepower: 12 at drawbar, 20 at belt-pulley
Length: 96 inches
Width: 50 inches
Height: 52 inches
Weight: 3455 pounds
Turning Circle: 12 feet
Traction Surface: About 800 square inches
Center to Center of Tracks: 38 inches
Belt Pulley: Diameter 8 inches, face 6 inches

A Southern city is using this Cletrac for all road maintenance jobs. With one man it is doing more work than the six mules and three drivers formerly used.

And Cletrac doesn't need any "breathing spells". It keeps busy every minute—handles all haulage and most belt jobs along the road.

Write direct to us for interesting facts about Cletrac's record on road work and see the Cletrac dealer near you.

Cletrac
TANK-TYPE TRACTOR

THE CLEVELAND TRACTOR CO.
"Largest Producers of Tank-Type Tractors in the World"
19211 Euclid Ave. Cleveland, Ohio.

Connery & Co., Inc., Philadelphia, Pa.
Eagle Tank Co., Chicago, Ill.
Lancaster Iron Wks., Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
United Iron Works, Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STEAM TURBINES
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***DeLaval Steam Turbine Co., Trenton, N. J.**
***Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.**
Ingersoll-Rand Co., New York.

STEEL PLATE CONSTRUCTION
***Chicago Bridge & Iron Works, Chicago, Ill.**
***Heil Co., The, Milwaukee, Wis.**
***Heltzel Steel Form & Iron Co., Warren, O.**
*Honhorst Co., Jos., Cincinnati, Ohio.
***Littleford Bros., Cincinnati, O.**
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Bethlehem Steel Bridge Co., Bethlehem, Pa.
Biggs Boiler Wks., Akron, O.
Birmingham Steel Corp., Birmingham, Ala.
Blaw-Knox Co., Pittsburgh, Pa.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
McClintic-Marshall Co., Pittsburgh, Pa.
Pennsylvania Bridge Co., Beaver Falls, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Pittsburgh, Pa.
Toledo Crane Co., Toledo, O.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Jersey City, N. J.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STOKERS, MECHANICAL
***Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.**
Babcock & Wilcox Co., N. Y. C.

STREET LAMP POSTS
***Electric Railway Equipment Co., Cincinnati, O.**
***General Elec. Co., Schenectady, N. Y.**
***King Mfg. Co., Chicago, Ill.**
***Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.**
*Union Metal Mfg. Co., Canton, O.

STREET AND ROAD SIGNS. (See Signs, Street and Road.)

STREET CLEANERS AND FLUSHERS
***Austin-Western Road Mchy. Co., Chicago, Ill.**
***Elgin Sales Corp'n., New York.**
***Federal Motor Truck Co., Detroit, Mich.**
***Good Roads Machinery Co., Philadelphia, Pa.**
***Municipal Supply Co., South Bend, Ind.**
***Rochester Can Co., Rochester, N. Y.**
***Thompson-Fleming Co., Inc., Buffalo, N. Y.**
***Tiffin Wagon Co., Tiffin, O.**
***Universal Road Mchy. Co., Kingston, N. Y.**
***White Company, Cleveland, O.**
Autocar Co., Ardmore, Pa.
Etnyre & Co., E. D., Oregon, Ill.
Four Wheel Drive Auto Co., Clintonville, Wis.
Service Motor Truck Co., Wabash, Ind.

STRUCTURAL, STEEL AND IRON. (See Bridges and Buildings)

STUMP PULLERS
Bennett & Co., H. L., Westerville, O.
Carpenter & Co., Geo. B., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Lewis & Valentine, Roslyn, L. I.
Thomas Elevator Co., Chicago, Ill.

SURVEYORS' INSTRUMENTS. (See Instruments.)

TABLES AND BOARDS, DRAWING. (See Drawing Materials.)

TAMPING MACHINES
***Pawling & Harnishfeger Co., Milwaukee, Wis.**
Construction Mach'y Co., Waterloo, Ia.

TANKS, AIR COMPRESSOR
***Chicago Bridge & Iron Works, Chicago, Ill.**
***Heil Co., Milwaukee, Wis.**
***Indiana Air Pump Co., Indianapolis, Ind.**
***Littleford Bros., Cincinnati, O.**
***Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.**
Abendroth & Root Mfg. Co., New York.
Biggs Boiler Wks., Akron, O.
Connery & Co., Inc., Philadelphia, Pa.
Ingersoll-Rand Co., New York.
Lancaster Iron Wks., Lancaster, Pa.
National Tube Co., Pittsburgh, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.
Westinghouse Tract. Brake Co., Wilmerding, Pa.
Worthington Pump & Machy. Corp., New York.

TANKS FOR OIL
***Chicago Bridge & Iron Works, Chicago, Ill.**
***Heil Co., Milwaukee, Wis.**
***Honhorst Co., Jos., Cincinnati, Ohio.**
***Littleford Bros., Cincinnati, O.**
***Pacific Tank & Pipe Co., San Francisco, Cal.**
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Biggs Boiler Works Co., Akron, O.
Bowser & Co., S. F., Fort Wayne, Ind.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Connery & Co., Philadelphia, Pa.
Dover Boiler Works, New York.
Fouts Co., C. C., Middletown, O.
Petroleum Iron Works Co., Sharon, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
United Iron Works, Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

TANKS, STEEL
***Chicago Bridge & Iron Works, Chicago, Ill.**
***Heil Co., Milwaukee, Wis.**
*Honhorst Co., Jos., Cincinnati, Ohio.
***Littleford Bros., Cincinnati, O.**
***Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.**
Biggs Boiler Wks., Akron, O.
Caldwell Co., W. E., Louisville, Ky.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Columbian Steel Tank Co., Kansas City, Mo.
Connery & Co., Inc., Philadelphia, Pa.
Hardesty Mfg. Co., R., Denver, Col.
Lancaster Iron Works, Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Scaife & Sons, Wm. B., Oakmont, Pa.

TANKS, WOOD
***Pacific Tank & Pipe Co., San Francisco, Cal.**
Caldwell Co., W. E., Louisville, Ky.
Davis & Son, G. M., Palatka, Fla.
Eagle Tank Co., Chicago, Ill.
Hauser-Stander Tank Co., Cincinnati, O.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
National Tank & Pipe Co., Portland, Ore.
Redwood Manufacturers Co., San Francisco, Calif.
Scaife & Sons, Wm. B., Oakmont, Pa.
Stearns Lumber Co., A. T., Boston, Mass.
U. S. Wind Engine & Pump Co., Batavia, Ill.
Wendnagel & Co., Chicago, Ill.

TANK WAGONS
***Acme Road Mach. Co., Frankfort, N. Y.**

TAPES, STEEL AND METALLIC
Dietzgen Co., Eugene, New York.
Keuffel & Esser Co., Hoboken, N. J.
Kolesch & Co., New York.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Athol, Mass.

TAR
***Barrett Co., New York.**

TAR KETTLES. (See Kettles)

TIES, STEEL
***Koppel Industrial Car & Equip. Co., Koppel, Pa.**
Carnegie Steel Co., Pittsburgh, Pa.
Sweet's Steel Co., Williamsport, Pa.

TIRES, RUBBER. (For Motor Trucks.)
***Kelly Springfield Tire Co., New York.**
Firestone Tire & Rubber Co., Akron, O.
Goodrich Rubber Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Republic Rubber Co., Youngstown, O.
U. S. Tire Co., New York.

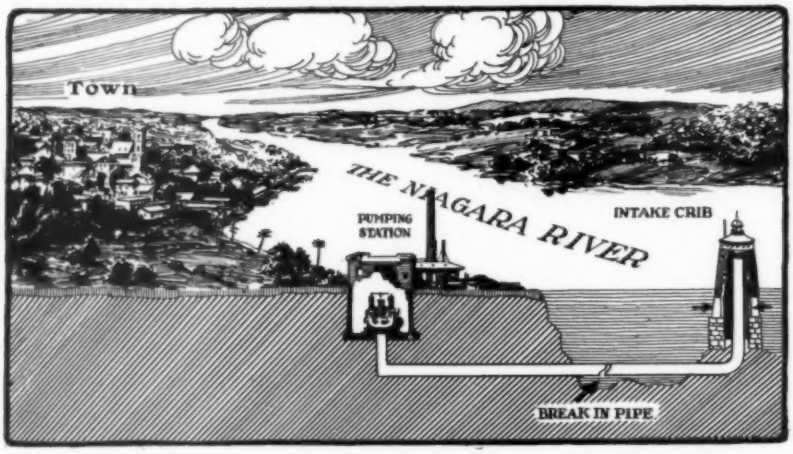
TOOL HOUSES, PORTABLE STEEL
***Littleford Bros., Cincinnati, O.**

TOWERS (See Standpipe Tanks and Towers)

TRACKS, INDUSTRIAL AND PORTABLE
***Koppel Ind. Car & Equipment Co., Koppel, Pa.**
Chase Fdry. & Mfg. Co., Columbus, O.
Easton Car & Constn. Co., New York.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Lakewood Engineering Co., Cleveland, O.
Light Railway Equipment Co., Philadelphia, Pa.

TRACTORS
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***Cleveland Tractor Co., Cleveland, O.**
***Dayton-Dowd Co., Quincy, Ill.**
***Fairbanks, Morse & Co., Chicago, Ill.**
***Holt Mfg. Co., Peoria, Ill.**
***White Company, The, Cleveland, O.**

** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*



THE POLLUTED, DEATH-DEALING WATER ALONG THE SHORES OF THE NIAGARA, ENTERED THE CITY WATER SUPPLY AND 236 PEOPLE WERE STRICKEN WITH TYPHOID FEVER.

The Damage Had Already Been Done

when Tonawanda installed W & T Apparatus in August, 1919.

The water supply of Tonawanda is drawn from an intake crib in the Niagara River, some 1800 feet out from the shore. Here the water is considerably more pure than along the banks of the stream, but even at that, the State Board of Health warned the town officials that the raw water of the Niagara should be sterilized. These warnings were repeatedly ignored.*

Tonawanda's lesson was ever so costly and sad. One day the pipe line was broken near the shore and water polluted with disease-bearing, death-inviting germs entered the city supply.

The grip of typhoid fever settled upon the town—the horror of water-borne pestilence, the disgrace of a preventable epidemic. Day after day her citizens were stricken—disease and death multiplied, until over two hundred people lay ill from typhoid and many more from severe intestinal trouble.

And then on August 11th W & T Apparatus and Liquid Chlorine, the first aid, the permanent aid of so many stricken communities began to sterilize every drop of Tonawanda's water. The epidemic was instantly checked and soon its deadly work was over.

If the W & T Apparatus had been installed on June 11th instead of August 11th, that epidemic would never have occurred—even if the intake pipe did break!

Why will so many cities and towns wait until the inevitable epidemic occurs before they take precautions? Your own town may be the next.

The approved method of water sterilization, the application of minute quantities of Liquid Chlorine to water by W & T Apparatus has saved more lives in the United States in the last ten years than were lost by the U. S. forces in the great war. Liquid Chlorine kills all disease-bearing bacteria and makes a community free from all danger of water-borne disease.

Over four billion gallons of water are being sterilized every day by over 4,000 installations of W & T Apparatus all over the world and at the surprisingly low cost of one cent for every 20,000 gallons of water sterilized. Let us send you today a copy of our booklet, "Why Sterilize Water?" and also send us the name of your water works superintendent so we may send him one.

*Reference—From a report by Theo. Horton, N. Y. State Board of Health.

WALLACE & TIERNAN CO., Inc.

NEWARK, NEW JERSEY

BRANCH OFFICES

Chicago Atlanta San Francisco
Pittsburgh Dallas Kansas City

Advance-Rumely Thresher Co., Laporte, Ind.
Avery Co., Peoria, Ill.
Bates Machine & Tractor Co., Joliet, Ill.
Best Tractor Co., C. L., San Leandro, Cal.
Case Threshing Machine Co., J. I., Racine, Wis.
Clark Tructractor Co., Chicago, Ill.
Dart Truck & Tractor Corp., Waterloo, Ia.
Four Wheel Drive Auto Co., Clintonville, Wis.
Hart-Parr Co., Charles City, Iowa.
Huber Mfg. Co., Marion, O.
J. T. Tractor Co., Cleveland, O.
Oliver Tractor Co., Knoxville, Tenn.
Selden Truck Corp'n., Co., Wabash, Ind.
Service Motor Truck Co., Wabash, Ind.
Watson Products Corp., Canastota, N. Y.

TRAILERS FOR MOTOR TRUCKS
Arcadia Trailer Corp., Newark, N. Y.
Eagle Wagon Works, Auburn, N. Y.
Highway Trailer Co., Edgerton, Wis.
Lee Trailer & Body Co., Chicago, Ill.
Troy Wagon Works, Troy, O.
Warner Mfg. Co., Beloit, Wis.
Watson Products Corp'n., Canastota, N. Y.

TRAILERS, INDUSTRIAL
Chase Fdry. & Supply Co., Columbus, O.
Electric Wheel Co., Quincy, Ill.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.

TRAMWAYS, AERIAL WIRE ROPE
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.

TRANSFORMERS
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***General Electric Co., Schenectady, N. Y.**
***Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.**
Kuhlman Electric Co., Bay City, Mich.

TRANSITS AND LEVELS. (See Instruments.)

TRANSMISSION MACHINERY, POWER
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***General Electric Co., Schenectady, N. Y.**
Dodge Mfg. Co. Mishawaka, Ind.
Link Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

TREADS, SAFETY
American Abrasive Metals Co., New York.
American Mason Safety Tread Co., Lowell, Mass.
Concrete Steel Co., New York.
Irving Iron Works, Long Island City.

TRENCH EXCAVATORS, (see Excavators, Ditch & Trench)

TURBINES
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***De Laval Steam Turbine Co., Trenton, N. J.**
***General Electric Co., Schenectady, N. Y.**
***Midwest Engine Co., Indianapolis, Ind.**
***Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.**
Ingersoll-Rand Co., New York.

USED MACHINERY
***Briggs, Inc., Marvin, Bkn., New York.**
***Craven Co., Frank T., New York.**
*Curtiss-Willis Co., New York.
***Forsythe Bros., New York.**
*Grey Steel Prod. Co., New York.
***King, Philip T., New York, N. Y.**

VALVE CONTROL APPARATUS, ELECTRIC
***Payne Dean Ltd., New York.**

VALVES, GATE AND INDICATOR POSTS
***Crane Company, Chicago, Ill.**
***Norwood Engineering Co., Florence, Mass.**
***Smith Mfg. Co., A. P., East Orange, N. J.**
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Darling Valve Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Pratt & Cady Co., Inc., Hartford, Conn.
Rensselaer Valve Co., Troy, N. Y.
Wood & Co., R. D., Philadelphia, Pa.

VALVE BOXES AND HOUSINGS
***Central Foundry Co., New York.**
***Mueller Mfg. Co., H., Decatur, Ill.**
***Pratt & Cady Co., Inc., Hartford, Conn.**
***Rensselaer Valve Co., Troy, N. Y.**
***Smith Mfg. Co., A. P., East Orange, N. J.**
***U. S. C. Ir. Pipe & Fdry. Co., Burlington, N. J.**
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Co., Troy, N. Y.
S. E. T. Valve & Hydrant Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

VENTILATORS
American Blower Co., Detroit, Mich.
Edwards Mfg. Co., Cincinnati, O.
Milwaukee Corrugating Co., Milwaukee, Wis.

WAGONS AND TRUCKS
***Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.**
***Russell Grader Mfg. Co., Minneapolis, Minn.**
***Tiffin Wagon Co., Tiffin, O.**
***White Company, The, Cleveland, O.**
Acme Wagon Co., Emigsville, Pa.
Eagle Wagon Works, Auburn, N. Y.
Troy Wagon Works, Troy, O.
Watson Products Corp'n., Canastota, N. Y.
Western Wheeled Scraper Co., Aurora, Ill.

WAGON BODIES. (See Dump Bodies)

WAGON LOADERS. (See Loaders, Gravel and Wagon)

WALLBOARD
***Carey Co., Philip, Cincinnati, Ohio.**
Beaver Board Companies, Buffalo, N. Y.
Bird & Son E. Walpole, Mass.
Cornell Wood Products Co., Chicago, Ill.
Haverhill Box Board Co., Haverhill, Mass.
McAndrews & Forbes Co., New York, N. Y.
Plastergon Wallboard Co., Buffalo, N. Y.
United States Gypsum Co., Chicago, Ill.
Upson Co., The, Lockport, N. Y.
Waldorf Paper Products Co., St. Paul, Minn.

WALL TIES
***Niagara Metal Stamp. Corp., Niagara Falls, N. Y.**
Concrete Steel Co., New York, N. Y.
Consolidated Expanded Metal Co., Braddock, Pa.
Berger Mfg. Co., Canton, O.
Milwaukee Corrugating Co., Milwaukee, Wis.

WATER MAIN CLEANING
***National Water Main Cleaning Co., New York.**

WATER MAIN TAPPING MACHINES
***Mueller Mfg. Co., H., Decatur, Ill.**
***Smith Mfg. Co., A. P., E. Orange, N. J.**

WATER METERS. (See Meters. Water and Oil.)

WATERPROOFING COMPOUNDS AND MATERIAL
***Barber Asphalt Paving Co., Philadelphia, Pa.**
***Barrett Company, New York.**
***Carey Company, Philip, Cincinnati, O.**
***Standard Oil Co. of Indiana, Chicago, Ill.**
***Texas Company, New York.**
***Truscon Steel Co., Youngstown, O.**
Anti-Hydro Waterproofing Co., New York.
Atlantic Refining Co., Philadelphia, Pa.
General Fireproofing Co., Youngstown, O.
Granitex Corp., New York.
Horn Co., A. C., Long Island City, N. Y.
Master Builders' Co., Cleveland, O.
Minwax Co., The, New York.
Protexol Corpn., New York.
Ruberoid Co., New York.
Sonneborn Sons, Inc., New York.
Toch Brothers, New York.

WATER PURIFICATION
***Electro Bleaching Gas Co., New York.**
***Hooker Electrochemical Co., New York.**
***Mathieson Alkali Works, Inc., New York.**
***Norwood Eng. Co., Florence, Mass.**
***Penna. Salt Mfg. Co., Philadelphia, Pa.**
***Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.**
***Wallace & Tiernan Co., Inc., New York.**
Clow & Sons, J. B., Chicago, Ill.
Permutit Co., New York.
R. U. V. Company, New York.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.

The Mathieson Alkali Works, Inc.

General Offices
25 WEST 43rd STREET
New York City

WORKS
Niagara Falls, N. Y.

WORKS
Saltville, Va.

EAGLE-THISTLE BRAND OF PRODUCTS

LIQUID CHLORINE

Pure, anhydrous, for use with any control apparatus, specially packed for Water Works' use in improved and convenient cylinders, 105, 150 lbs., and 2000 lbs.
We can make prompt and regular shipments and shall be pleased to quote for spot and contract deliveries.
Our Gray Cylinders are devoted exclusively to Water Works Service. Insist upon the GRAY.

CHLORIDE OF LIME

In 225, 300, 450 and 750-lb. drums. Strongest, quickest-settling, most uniform and reliable. Special Drums for export.

SODA ASH

In barrels or bags. Our 58% light ash is uniform in strength and purity and has no equal as a water softener.

If you have a problem to solve advise us and get the advantage of the services of our Technical Department.

The BACKBONE of Concrete Highways

National Road Fabric

A welded, rigid fabric, every ounce of which is "effective"—no metal wasted in wraps or ties.
Buy National Road Fabric and save freight and the cost of handling excess tonnage.

Easily Handled

Most contractors (98% in 1920) buy National Road Fabric in rolls and straighten it on the job in a machine which we furnish for the purpose. In this way they save (based upon figures which they submitted) approximately 2c per square yard in handling cost alone.

Write for catalogue and prices.

NATIONAL STEEL FABRIC COMPANY
(Subsidiary of Pittsburgh Steel Company)
909 First Nat'l Bank Bldg., Pittsburgh, Pa.
Distributors in the Principal Cities

MIDWEST UTILITOR ROAD MAINTAINER

Here is a Road Maintainer Every Contractor Ought to Know About

Complete information on request. Please address Sales Division·R10.

Midwest Engine Co.
Indianapolis, U. S. A.

WOLVERINE MIXERS

A Knickerbocker Product

¶ The Wolverine Concrete Mixers successfully fill a big need right now, both in the building field and in the construction of sidewalks, bridges and culverts, for a well made, low priced mixer.

¶ The special design of these mixers, together with the quantity built, permits us to make them the desired weight for portability, and of sufficient strength to withstand the hard work they are subjected to on the job, and still sell them at exceedingly low prices.

THE KNICKERBOCKER CO., 338 Liberty St., JACKSON, MICH., U. S. A.
Knickerbocker Line of Concrete Mixers, Mortar Mixers, Portable Saw Rigs

WATER REGULATORS
*Mueller Mfg. Co., Decatur, Ill.
*Pacific Flush Tank Co., Chicago, Ill.
*Union Water Meter Co., Worcester, Mass.

WATER SOFTENERS
*N. Y. Continental Jewell Filtr. Co., Nutley, N. J.
*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.
American Water Softener Co., Philadelphia, Pa.
Borromite Co., Chicago, Ill.
International Filter Co., Chicago, Ill.
Permutit Company, New York.
Refinite Co., Omaha, Neb.
Roberts Filter Mfg. Co., Darby, Pa.
Scaife & Sons, W. B., Pittsburgh, Pa.

WATER WHEELS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Leffel & Co., Jas., Springfield, O.
Pelton Water Wheel Co., San Francisco, Cal.
Smith Company, S. Morgan, York, Pa.

WELDING APPARATUS
*General Electric Co., Schenectady, N. Y.
Milburn Company, Alex., Baltimore, Md.
Oxweld Acetylene Co., Newark, N. J.

WELL SCREENS
*Johnson, Edw. E., Inc., St. Paul, Minn.

WELL-DRILLING AND BLAST HOLE MACHINES
*American Well Works, Aurora, Ill.
Armstrong Mfg. Co., Waterloo, Iowa.
Keystone Driller Co., Beaver Falls, Pa.
Leidecker Tool Co., Marietta, Ohio.
Loomis Machine Co., Tiffin, O.
Sanderson Cyclone Drill Co., Orrville, Ohio.
Sparta Iron Wks. Co., Sparta, Wis.
Star Drilling Machine Co., Akron, O.

WHEELBARROWS
*Standad Scale & Supply Co., Pittsbugh, Pa.
Akron Cultivator & Mfg. Co., Akron, O.
Jackson Mfg. Co., Harrisburg, Pa.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lansing Co., Lansing, Mich.
Sidney Steel Scraper Co., Sidney, O.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Stuebner Iron Wks., G. L., Long Island City, N. Y.
Toledo Wheelbarrow Co., Toledo, O.

WINDOW FRAMES AND SASH. (Metallic.)
International Steel & Iron Co., Evansville, Ind.
Lupton's Sons Co., David, Philadelphia, Pa.

WIRE AND CABLE
*General Electric Co., Schenectady, N. Y.
*Simplex Wire & Cable Co., Boston, Mass.
American Steel & Wire Co., Chicago, Ill.
Habirshaw Elec. Cable Co., Inc., N. Y. C.
Hazard Mfg. Co., Wilkesbarre, Pa.
Macwhyte Co., Kenosha, Wis.
National India Rubber Co., Bristol, R. I.
New York Insulated Wire Co., New York.
Okonite Co., New York.
Roebling's Sons Co., J. A., Trenton, N. J.
Safety Ins. Wire & Cable Co., New York.
Standard Underground Cable Co., New York.
Tubular Woven Fabric Co., Pawtucket, R. I.
Waterbury Co., New York.

WIRE GLASS
Mississippi Wire Glass Co., New York.

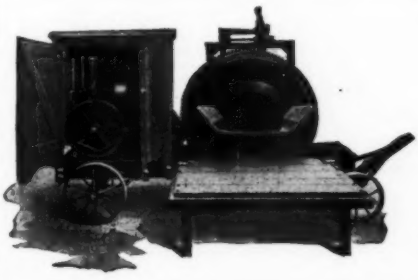
WIRE MESH REINFORCEMENT
*American Steel & Wire Co., Chicago, Ill.
Wickwire Spencer Steel Corp., Worcester, Mass.

WIRE ROPE. (See Rope, Wire.)

WOODWORKING MACHINES
*Fairbanks-Morse & Co., Chicago, Ill.
*Ransome Concrete Mach. Co., Dunellen, N. J.

WOOD PRESERVATIVES
*Barrett Company, New York.
*Republic Creosoting Co., Indianapolis, Ind.
Protexol Corpn., New York.

WRENCHES
Erie Tool Works, Erie, Pa.
Greene, Tweed & Co., New York.
Lowell Wrench Co., Worcester, Mass.



"THE STANDARD" LINE OF
Contractors' Equipment

Concrete Mixers, Street Pavers, Hoists, Pumps, Gas, Gasoline and Oil Engines, Material Elevators, Spouting Equipment, Wheelbarrows, etc. Also wagon and motor truck scales. Send for Catalogue No. 69.

THE STANDARD SCALE AND SUPPLY COMPANY
1631 Liberty Avenue, Pittsburgh, Pa.
New York Philadelphia Baltimore Cleveland Chicago Detroit Dallas

SEWER PIPE

CULVERT PIPE — WALL COPING — FLUE LINING
STOVE PIPE — BUILDING BLOCKS
DRAIN TILE — FIRE CLAY — ETC.
WRITE FOR INFORMATION

THE DELAWARE CLAY PRODUCTS CO.
807 WESTINGHOUSE BLDG. PITTSBURGH, PA.

Bids thrown

Contractors Spotlighted as Greedy Grabbers by the Public Press!

AND, in the greatest number of instances this deplorable accusation is unjustified—due to misconceptions and misunderstandings.

One of the causes, the Koehring Company believes, is the injudicious advertising of day-run mixer "records."

Such "records," of course, as every contractor and engineer understands, are not common, not average performances, not representative, and not ***possible,*** except under extremely fortunate combinations of circumstances peculiar to particular jobs.

Yet, don't forget that these exceptional records are likely to be used as a basis for "checking" up on "bids" and cost figures.

They are misleading to public and inexperienced estimators.

95% of road work is under average conditions, not more than 5% under conditions where record yardage results are possible.

To put the spotlight on yardage records of the 5%, the Koehring Company believes to be bad for business—bad for the industry.

The Koehring Company refrains from featuring the remarkable Koehring records in its advertising—because such records are misleading to contractors who will do 95% of the jobs under average conditions—and because, under present conditions, it is harmful to the industry.

KOEH

out! Work held up!

Now, to forestall the skeptic, if there is one who might believe that the Koehring paver has made no remarkable records, here are the figures of G. P. Scharl, Muskegon, Mich., with a Koehring 28-E Paver, on a 7″ x 8″, 18 foot road, one-minute mixing time.

April 28—1105 lineal feet in 9 hrs.
April 30— 800 lineal feet in 7½ hrs.
May 11—1240 lineal feet in 9 hrs.
May 20—1304 lineal feet in 9 hrs.

Beyond all question Mr. Scharl, and the Koehring paver, holds the world's records—and Koehring yardage records will be confidentially given to contractors and engineers, with permission of contractors making them—but, except in the instance of this advertisement, such records will be eliminated from Koehring advertising for the good of the contractor, and the industry.

After all, we are frank to say that day-run records do not express true mixer value, either of the Koehring or any other mixer. It's the **season's yardage** that counts—the ability of a mixer to stand up under top speed operation, to handle all the materials brought to it, under all conditions, and to do it without breakdowns and delays—and these are reasons why we call the Koehring the **heavy duty, extra yardage mixer**—the mixer of longest service life.

Koehring Capacities

PAVERS—7, 10, 14, 21, 28 cu. ft. mixed concrete. Steam and gasoline, boom and bucket or spout distribution, multi-plane traction, power discharge chutes.

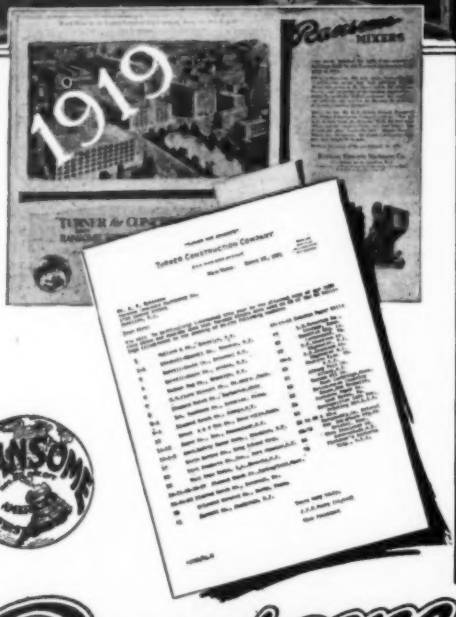
KOEHRING HEAVY DUTY CONSTRUCTION MIXERS—10, 14, 21, 28 cu. ft. mixed concrete. Power charging skip, batch hoppers, steam and gasoline.

KOEHRING DANDIE MIXERS—4 and 7 cu. ft. mixed concrete; steam or gasoline, low charging platform, power charging skip, automatic water measuring tank, and light duty hoist. The dependable light mixer for culverts, footings, etc.

RING

THE KOEHRING COMPANY • • • MILWAUKEE WISCONSIN

Work Done *by the* Turner Construction Co. *during year* 1920



And in 1920, too,—

In both number of jobs served and volume of concrete mixed, the Turner Construction Company shows a marked preference for Ransome equipment.

In 1920 Ransome Mixers, both in point of comparative numbers and in the total yardage of concrete mixed, far exceeded the total of all other makes of mixers owned by Turner,

1917-1918-1919 and 1920 "Turner Cities" are—by comparison—almost exclusively "Ransome Cities." The mechanical reasons for the supremacy of Ransome Mixers are given in Bulletin 104.

Ransome

CONCRETE MACHINERY CO.

1772 Second Street, Dunellen, N. J.

Manufacturers of Mixers, Pavers, Pneumatic Mixers, Chuting Plants, Hoist Buckets, Bins, Cars, Carts, etc.

EDGAR J. BUTTENHEIM, President — HERBERT K. SAXE, Treasurer — L. P. ANDERSON, Secretary — THEO. R. KENDALL, General Manager — ARTHUR FREUND, Advertising Manager

CONTRACTORS' & ENGINEERS' MONTHLY

A PURCHASING GUIDE FOR ENGINEERS, CONTRACTORS, PUBLIC OFFICIALS AND OTHER PURCHASERS OF CONSTRUCTION MATERIALS AND EQUIPMENT

Published at 154 Nassau St., New York City, by The Civic Press, Inc.

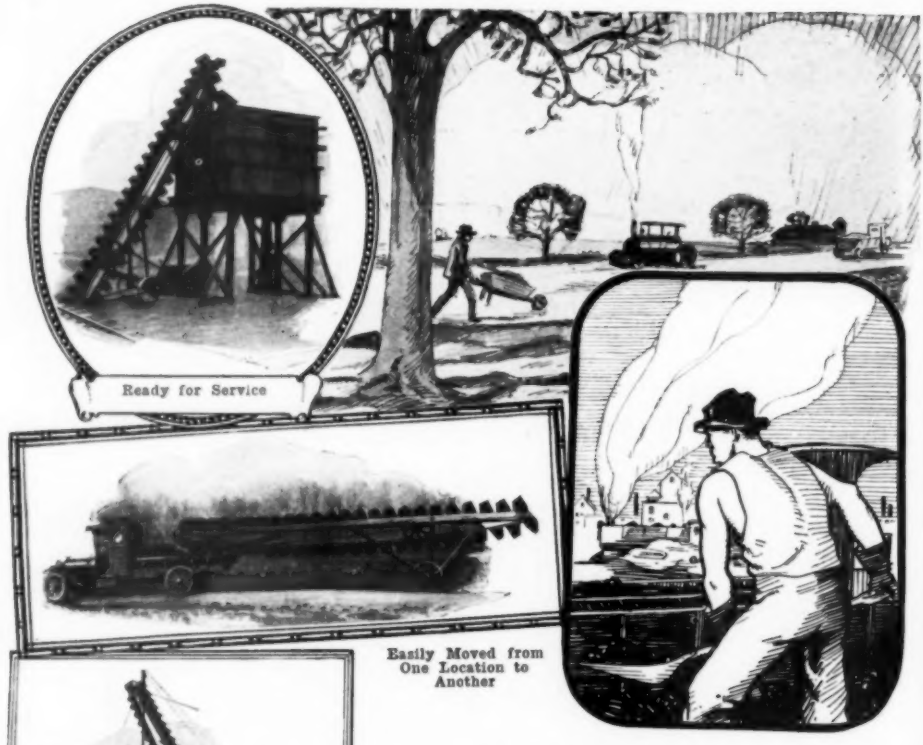
25 Cents a Copy. $1.00 a Year

Branch Offices Chicago, Ill., 327 So. LaSalle Street. Tom Dix, Vice-President
San Francisco, 320 Market Street. W. A. Douglass, Pacific Coast Representative

TABLE OF CONTENTS FOR JUNE, 1921

EDITORIAL

An Accepted Rental Schedule 43
Annual Charge Against Treated Timber 46
New Asphalt Plant Shows Many Improvements 51
A Poet's Advice on Good Roads 51
Miscellaneous Contract Hauling in Cleveland 52
The Safe Storage of Explosives 53
Competition for Plan for Sewerage System, Chauny, France 54
The Care of Concrete Mixers 55
A Portable Unloader and Storage Bin 57
Loading Device for Gravel and Crushed Stone 58
Suggestions for Asphalt Paving Contractors—Part III 59
For Engineers—For Contractors 63
Contractors', Engineers' and Manufacturers' Notes 65
Dirt- and Material-Handling Machinery 66
Mule vs. Tractor in Grading 67
Reinforcing Concrete Roads 68
Road-Building Organization 69
Automatic Lowering Jacks 71
Mileage of Public Roads in the United States 71
The Control of Explosives 72
The Engineer's Obligations 72
Building Toronto's New Harbor 73
A New Gravity-Dump Body for Motor Trucks 74
A Light-Weight Reversible Road Machine 74
Heavy Paver Shows Speed in Handling Dry Mix 76
The National Standard Truck Cost System 78



DON'T SHOVEL DOLLARS AWAY

The Fairfield Portable Equipment for Unloading cars will save you $8.50 to $9.50 per car.

It handles sand, gravel, slag, crushed stone, etc., unloading from hopper-bottom cars directly into a storage bin from which the material is dropped onto the trucks or wagons.

A car is unloaded in one hour to an hour and a half; trucks and wagons are loaded in one to three minutes. The Fairfield Equipment replaces 20 to 30 men, handling from 30 to 40 tons of material per hour.

This equipment is easily erected, dismantled and moved from job to job. Not a nail required. Power furnished by 7½ H. P. Motor or 8 H. P. Kerosene Engine. The outfit complete as illustrated includes elevator, track feeder, bin and 8 H. P. Kerosene Engine, but may be purchased without bin or engine.

Write for complete specifications and price for immediate delivery.

THE FAIRFIELD ENGINEERING CO.

Lancaster, Ohio

FAIRFIELD
CONTRACTORS MACHINERY

Contractors' & Engineers' Monthly

New York June, 1921

An Accepted Rental Schedule

The Associated General Contractors Have Prepared a Guide to Estimate Construction Equipment Expense Which Has Been Accepted in the Courts and Which Will Undoubtedly Remain the Standard for Equipment Rental for Many Years to Come

A RENTAL schedule that will furnish contractors with a practical means of estimating equipment expense and determining adequate rental charges was the objective sought by the Committee on Methods of the Associated General Contractors in working out a standard schedule. Such a schedule, evolved from the records and experience of contractors, manufacturers and rebuilders of equipment, has been prepared and is presented herewith.

To use the schedule with safety, it is essential to understand how the amounts were obtained, how they are to be applied, and how they are limited for determining rental charges. Knowing these things, no great difficulty should be found in establishing the charges within the bounds of practical accuracy. For the reason that arithmetical averages as obtained from available records gave few rational values for depreciation and repairs, such averages were given less weight in establishing the tabular amount than the practical experience of contractors. In fact, the strongest evidence that these amounts are reasonably safe and accurate lies in the endorsement given them by experienced general contractors. As it now stands, the schedule represents the consensus of opinion of many contractors, and with a proper understanding of what the percentage amounts mean, it should offer a safe means of estimating rental charges.

What the Values Mean

The endless variation of job conditions, such as topography, ground formation, and climate, indicates how great may be the error of any fixed equipment charge when applied to the exceptional job. But having figures which represent the mean of many projects, a starting point exists for ascertaining rental charges for exceptional circumstances. Figures given in the standard schedule may be said to show equipment expense when the machines are not required to operate continuously either under the worst or the best of operation strains. When no especially favorable or unfavorable circumstances attend the project, the tabular values probably give the extent within a permissible error.

To eliminate error as far as possible by permitting consideration and comparison of the individual items that make up equipment expense, the gross amounts are reduced to their component parts. Thus any item of expense which is known to be unusually high in specific cases may be adjusted in the schedule to obtain a more appropriate rental rate.

Components of Expense

Seven items of equipment expense constitute the total rental charges and require consideration in estimating a lump sum contract or in determining fixed-rate rentals. An average value for each of these items which represents the expense of a general contractors' outfit as a whole has been approved by the Executive Board of the Associated General Contractors. The items referred to and their annual proportions of the equipment's initial cost are as follows.

Schedule of Typical Rental Charge

Items of expense are expressed as per

cents of original capital investment for equipment having a useful life of 6 years and a salvage value of 25 per cent of the original cost.

	Per Cent
1. Average depreciation	12½
2. Equivalent annual interest at 6½ per cent.	4
3. Shop repairs	6
4. Field repairs	4
5. Storage and incidentals	3½
6. Insurance	1
7. Taxes	1
Total annual expense	32
Equivalent expense on a basis of 8 months' working time per year	48
Rental rate per month	4

How to Obtain Proper Percentage

These percentages and those given in the detailed schedule were determined according to the following principles:

The economical life of a machine is considered to end when its value has depreciated to 25 per cent of the original cost. The average annual depreciation then amounts to 75 per cent of the initial cost divided by the number of years it may be expected to give service. The initial cost of a machine is represented by the cost of that machine delivered at the contractor's yard.

Interest should naturally be charged at the prevailing rate. This may be computed in three ways:

1. By charging the prevailing rates each year on the depreciated value of the machine.
2. By charging the prevailing rate each year on the average value of the machine during economical life. For example, when the salvage rate value is 25 per cent, the average value equals (100 per cent + 25 per cent) divided by 2 = 62½ per cent.
3. By finding the proportion which the average value is of the initial cost and charging this proportion of the prevailing rate each year. This proportion is called the equivalent annual interest and shows what interest rate on original cost will yield the same interest as the prevailing rate when applied to the depreciating value of the machine. This is the method used in the above schedule. The average value is 62½ per cent of the original; therefore the equivalent annual rate is 62½ per cent of the prevailing rate, or 62½ per cent of 6½ per cent = 4 per cent.

Shop and field repairs are separated by reason of a previous recommendation of the Committee on Methods that field repairs be considered a part of the cost under cost plus contracts, and shop repairs be borne by the contractor and covered by the fixed rate rental charge. This recommendation was made on the ground that an owner should not be made to pay the total cost, for example, of re-fluing a boiler which may have been burned out principally on another owner's work.

The other items of cost require no special explanation.

Three Types of Charges

Owners of equipment find occasion to establish rental rates as follows:

1. For a lump sum or unit price estimate
2. To owners on a cost plus work
3. To other than client owners

In these instances charges should be made as follows:

1. The rental charge or equipment expense for lump sum work includes all the items mentioned above.
2. The fixed rate to owners on cost plus work will include all but field repairs, if this item is paid as a cost of the work. To the amount thus determined may be added a service charge depending upon the policy of the contractor, that is, whether the service of equipment is included in the profit fee or carried in the rental charge.
3. The charge to persons other than client owners includes all the items of expense and an additional amount for profit or payment for the machine's earning power.

A further consideration in each of these cases is the rate for double-shift work, where the percentages for depreciation and repairs should be doubled, or nearly so.

Individual Judgment Essential

The committee desires to emphasize the fact that the values presented in the following table should not be considered absolute in determining a rental charge. A real danger presents itself in using any tabular percentage without investigating the conditions under which the equipment is to work. To illustrate: If the values here given for a standard-gage shovel outfit were applied to such an outfit engaged constantly in excavating hard rock, the probability is that the charges allowed would not cover more than half the expense. The frequent dobey shots and the dropping of heavy boulders into cars entail a higher rate of depreciation and repairs than is given in the schedule. On the other hand, if this shovel outfit were steadily engaged in digging sandy loam, the values given in the table would probably cause the equipment charge to contain a fair per cent of profit.

It is with the understanding that individual judgment and experience should adjust

the tabular values to meet unusual conditions that this schedule is offered to contractors.

Individual Equipment Rental Schedule

The component expenses incurred by the ownership and maintenance of construction plant are expressed in this table as percentages of the initial cost for individual items of equipment. They indicate the probable annual expense without profit under ordinary job conditions and should be included in any lump sum estimate or in determining time-rate rental charges. The salvage value in all cases is considered to be 25 per cent of the initial cost.

Total percentage amounts in the extreme right-hand column should be applied to the total cost of a machine, including charges for transportation from the factory. This gives the total annual charge, which for a lump sum contract covering a full season is the total equipment expense. For determining a monthly, weekly or daily rental rate, the annual amount is divided by the number of such periods in the year during which it is possible for the contractor to carry on construction work.

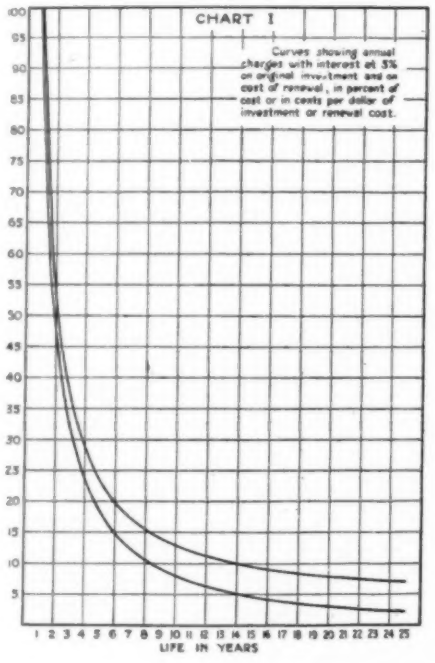
Items of Equipment	Economical Life	Depreciation	Interest at 6½%	Shop Repairs	Field Repairs	Storage Incidentals	Insurance	Taxes	Total
	Yrs.	%	%	%	%	%	%	%	%
Auto-crane	5	15	4	6	5	3½	1	1	35½
Auto-truck	3	25	4	20	20	3½	1	1	74½
Auto-trailer	5	15	4	6	5	3½	1	1	35½
Backfiller, power	4	18¾	4	6	7	3½	1	1	41¼
Ballast spreader	8	9½	4	6	4	3½	1	1	29
Boiler, upright	8	9½	4	20	5	3½	1	1	44
Boiler, locomotive	8	9½	4	15	5	3½	1	1	39
Bucket, clam shell	4	18¾	4	13	6	3½	1	1	49¼
Bucket, orange-peel	4	18¾	4	25	6	3½	1	1	59¼
Bucket, drag-line	4	18¾	4	12	3	3½	1	1	43¼
Cars, steel dump	6	12½	4	8	4	3½	1	1	34
Cars, wood dump	5	15	4	7	3	3½	1	1	34½
Cars, flat	8	9½	4	4	3	3½	1	1	26
Cars, hopper	5	15	4	8	3	3½	1	1	35½
Compressor, steam	7	10¾	4	6	3	3½	1	1	29¼
Compressor, gasoline	4	18¾	4	6	7	3½	1	1	41¼
Compressor, electric	6	12½	4	3	3	3½	1	1	28
Concrete chutes	2	37½	4	15	15	3½	1	1	77
Conveyor, belt	2	37½	4	7	6	3½	1	1	60
Conveyor, bucket	2	37½	4	10	6	3½	1	1	63
Crusher, rock	6	12½	4	5	3	3½	1	1	30
Derrick, wood	5	15	4	4	4	3½	1	1	32½
Derrick, steel	10	7½	4	4	3	3½	1	1	24
Dragline, steam	6	12½	4	9	8	3½	1	1	39
Dragline, gasoline	4	18¾	4	10	10	3½	1	1	48¼
Dragline, electric	8	9½	4	7	7	3½	1	1	33
Drill, tunnel carriage	5	15	4	8	8	3½	1	1	40½
Drill, traction well	6	12½	4	7	10	3½	1	1	39
Drill, tripod	4	18¾	4	7	10	3½	1	1	45¼
Drill, jack hammer	4	18¾	4	7	6	3½	1	1	41¼
Engine, gas	6	12½	4	8	8	3½	1	1	38
Engine, steam	10	7½	4	5	5	3½	1	1	27
Excavator, cableway	6	12½	4	4	12	3½	1	1	38
Excavator, Keystone	5	15	4	8	4	3½	1	1	36½
Excavator, trench	5	15	4	8	6	3½	1	1	39½
Forms, steel concrete	2	37½	4	20	20	3½	1	1	87
Graders, common road	4	18¾	4	12	6	3½	1	1	46¼
Graders, elevating	4	18¾	4	15	7	3½	1	1	50¼
Hoist, steam	10	7½	4	6	4	3½	1	1	27
Hoist, gasoline	6	12½	4	7	8	3½	1	1	37
Hoist, electric	8	9½	4	5	3	3½	1	1	27
Locomotive, Indus. steam	9	8½	4	6	4	3½	1	1	28
Locomotive, Indus. gas	4	18¾	4	13	10	3½	1	1	51¼
Locomotive, Indus. battery	4	18¾	4	15	4	3½	1	1	47¼
Locomotive, Standard gage	10	7½	4	6	4	3½	1	1	27
Locomotive crane, steam	8	9½	4	7	8	3½	1	1	34
Locomotive crane, elect	8	9½	4	6	4	3½	1	1	29
Mixer, steam	5	15	4	12	4	3½	1	1	40½
Mixer, gasoline	4	18¾	4	13	8	3½	1	1	49¼
Mixer, electric	6	12½	4	12	4	3½	1	1	38
Mixer, paving steam	5	15	4	13	4	3½	1	1	41½
Mixer, paving gas	3	25	4	16	9	3½	1	1	59½
Motors	6	12½	4	6	4	3½	1	1	32
Pile driver, steam	8	9½	4	7	5	3½	1	1	31
Pile driver, track	10	7½	4	5	3	3½	1	1	25
Pile hammer, steam	7	10¾	4	7	3	3½	1	1	30¼
Pipe, galvanized	3	25	4	5	6	3½	1	1	45½
Plows	3	25	4	15	10	3½	1	1	59½
Pneumatic concr. mach	4	18¾	4	20	8	3½	1	1	56¼
Pump, centrifugal	8	9½	4	6	4	3½	1	1	29
Pump, piston	6	12½	4	7	5	3½	1	1	34
Pump, impulse	8	9½	4	2	4	3½	1	1	25
Rails	8	9½	4	5	3	3½	1	1	27
Riveter, air	5	15	4	8	4	3½	1	1	36½
Rock channeler	6	12½	4	7	8	3½	1	1	37
Roller, steam road	10	7½	4	5	3	3½	1	1	25
Saw rigs	4	18¾	4	10	15	3½	1	1	53¼
Scraper, wheel	3	25	4	8	4	3½	1	1	46½
Scraper, slip	1	75	4	25	10	3½	1	1	119½
Scraper, fresno	2	37½	4	25	15	3½	1	1	87
Shovel, steam	6	12½	4	7	6	3½	1	1	35
Shovel, gasoline	4	18¾	4	9	7	3½	1	1	44¼
Shovel, electric	7	10¾	4	6	5	3½	1	1	31¼
Switches, fabricated	3	25	4	3	3	3½	1	1	40½
Tower, steel hoist	7	10¾	4	3	4	3½	1	1	27¼
Tractor, wheel gas	6	12½	4	9	5	3½	1	1	36
Tractor, caterpillar	5	15	4	15	10	3½	1	1	49½
Wagons, dump	4	18¾	4	17	3	3½	1	1	48¼
Wagons, hauling	4	18¾	4	12	3	3½	1	1	43¼
Wagon loaders, power	5	15	4	10	6	3½	1	1	40½

Annual Charge Against Treated Timber*

By E. F. Paddock

THE art of preserving wood has reached a point where it is admitted to be a financially sound proposition. Railroads spend thousands of dollars for plants to preserve their ties, and thousands more for preservatives, and find it a paying investment. In the mind of every man who uses timber, be it much or little, the questions arise, "How much can I afford to spend for preservative treatment? Shall I gain or lose by it? Will it pay?"

Attempts have been made to determine just how much preservative treatment is worth, but they have been confined largely to specific cases. It is the writer's object to present certain data based on sound financial rules whereby it may be determined accurately and without complicated mathematical processes just how much one can afford to spend in order to extend the life of his timbers, or how much he can save by so doing.



In the first place, it will be evident that the actual cost of the timber is not the initial cost, but rather the cost per year, or the annual charge, and that this will depend upon the life of the timber. Let us assume that in order to purchase the timber we must borrow money at interest, and that we wish to pay back this money in equal amounts annually at such a rate that we shall just wipe out the debt in the lifetime of the timber. The amount of these annual payments is the annual charge; it is what our timber is actually costing per year.

Suppose C = the borrowed capital = cost of timber in place.
r = the rate of interest expressed as a decimal.
n = life of the timber in years.
a = annual charge.

If the timber lasts but one year, a = (1 + r) c, or the borrowed capital plus the interest for one year.

The general formula for a term of n years is as follows:

$$a = c\,\frac{r}{(1+r)^{n-1}} + r$$

From this formula I have for convenience determined the value of "a," or the annual charge, for terms of from 1 to 25 years with annual interest at 5 per cent. These values in Table 1 are expressed in per cent of the initial cost of the timber in place, that is, including the labor charge for erection, or in cents for each dollar invested. They have been figured out to the eighth decimal place, and the table as here produced permits a possible error of less than ½-cent in the annual charge on $1,000.

Let us, for example, suppose that the timber costs $2,000 in place and has an average life of 5 years. According to the table, the annual charge at 5 per cent interest is 23.0975 per cent of $2,000, or $461.95. Suppose, then, that $2,000 is borrowed at 5 per cent. At the end of the first year this amounts to $2,100.00, on which we pay

* Copyright, 1921.

TABLE I

Annual Charge in Per Cent of Original Cost for Various Periods

Life in Years	Annual Charge in Per Cent of Original Cost	Life in Years	Annual Charge in Per Cent of Original Cost	Life in Years	Annual Charge in Per Cent of Original Cost
1	105.0000	10	12.9505	18	8.5546
2	53.7805	11	12.0390	19	8.2745
3	36.7209	12	11.2825	20	8.0243
4	28.2012	13	10.6456	21	7.7996
5	23.0975	14	10.1024	22	7.5970
6	19.7017	15	9.6342	23	7.4137
7	17.2820	16	9.2270	24	7.2479
8	15.4722	17	8.8699	25	7.0953
9	14.0690				

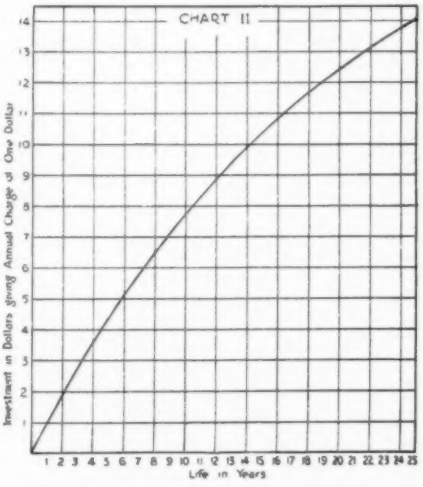
$461.95, leaving a residual debt of $1,638.05 at the beginning of the second year. At 5 per cent this amounts to 1.05 x $1,638.05, or $1,719.95 at the end of the second year, on which we again pay off $461.95, and we still owe $1,258 at the beginning of the third year.

There are various ways of viewing this problem and of handling the financial end of the business of construction and maintenance, but to my mind this is the most rational as well as the simplest. Various authorities have derived formulae and tables for computing these annual charges, but the only one that I have been able to find that uses this principle is Dr. B. E. Fernow. Dr. Fernow, at the time Chief of the Forestry Division of the U. S. Department of Agriculture, published in Bulletin No. 1 of that Division in 1887 two tables, one showing the annual charges against ties costing various amounts and lasting for various periods, and the other showing the annual charge against ties for renewal.

It was the writer's original intention to use Dr. Fernow's formula and table in the present discussion, but his formula was so stated as to be somewhat obscure. Furthermore, his table gives results correct only to the first decimal place, which means a possible error of 5 cents in the annual charge on an investment of $100, and a serious error occurs in the annual charge figure for a period of 12 years. In view of these facts, it was thought best to restate the formula in a clearer and more understandable form and to derive from the formula a corrected table which gives values that are much more accurate for precise calculation. The result is here presented, and in addition the table has been put in the form of a curve (Chart 1) from which approximate values may be obtained for rapid estimating and comparison. This formula has been checked and confirmed by Emil Kline, Vice-President of the Irving National Bank of New York City.

A Specific Example Computed

As an example of the operation of Table 1, let us take the case of the Denver City Tramway Company. This company's untreated ties were completely decayed in 5 years. Let us suppose that they cost 65 cents each, and that the labor of putting them into the track amounted to 20 cents each, making a total cost of 85 cents in the track. The annual charge at 5 per cent on 85 cents for 5 years is 23.0975 per cent of 85 cents, or 19.6 cents. The cost of treatment with Protexol, a wood preservative, is an average of 17 cents and the life of the treated ties is 10 years. The treated tie then costs 85 cents plus 17 cents, or $1.02, and lasts 10 years. The annual charge will be, according to the table, 12.9505 per cent of $1.02, or 13.2 cents, as compared with 19.6 cents for the untreated tie, an actual saving of 6.4 cents per tie per year. If the ties are laid 18 inches center to center, this means 3,520 ties per



INVESTMENT WHICH WILL GIVE AN ANNUAL CHARGE OF $1.00 FOR ANY GIVEN TERM OF YEARS

mile, or a saving of $225.28 per mile per year. On the entire system of 31.874 miles of track this amounts to $7,180.57 per year, which is equivalent to a 4 per cent dividend on $1,795.14.

Suppose now that a certain structure lasts 5 years untreated. We know that the annual charge against this timber is 23.0975 per cent of the original cost. Now, if by some preservative process it is possible to lengthen the life to 7 years, by reference to the table we find that the annual charge is only 17.2820 per cent of the initial cost. Then if the annual charge is to remain unchanged, it is proper to increase the initial cost to $\frac{23.0975}{17.2820}$ or 1.336 times the cost of the untreated timber. In other words, one can afford to spend 33.6 cents on every dollar's worth of such timber for a treatment that prolongs its life from 5 years to 7 years and not increase the annual charge. With lumber at $40 per thousand feet B.M., this means an allowable limit of $13.44 per thousand feet for treatment. If the life is extended to 10 years, or double the life of untreated timber, the allowable limit is $.7835 on $1.00, or $31.34 per thousand feet. Treatment with a good preservative costing $10 per 1,000 feet B.M., or less, would accomplish the same result at a net saving in this case of $21.34 on every 1,000 feet B.M.

The Clinton Woolen Manufacturing Company, of Clinton, Mich., actually increased the life of the timbers on its dye-house roof from 5 years untreated to 10 years with a brush treatment. These timbers were 4 x 8-inch white pine, which would require for one brush coat approximately 4 gallons of Protexol per 1,000 feet B.M. Probably $5 per 1,000 feet B. M. would amply cover the cost of treatment. Putting the price of white pine at $100 per 1,000 feet, a very low figure to-day, they could afford to spend $78.35 per 1,000 to obtain a result which actually costs only $5.00, a net saving of $73.34 per 1,000 feet B.M.

A similar case is that of the Hutchinson Inter-Urban Railway Company, whose untreated ties lasted only 5 years. These ties, according to the company's own statement, cost 70 cents each. Treatment with Protexol costing 15 cents increased the life to 10 years. According to the tables, the company could afford to spend 78.35 per cent of 70 cents, or $.548 per tie, to obtain the result that cost them but 15 cents, the actual saving being 39.8 cents per tie.

The second curve (Chart 2) shows the investment which will give an annual charge of $1.00 for any given term of years from 2 to 25 years. This curve shows that an investment of $4.329 will require an annual payment or charge of $1.00 if the life of the timber is 5 years, while if the life is increased to 7 years we can invest $5.786 and the annual charge remains $1.00 per year. In other words, we can spend the difference between $4.329 and $5.786, or $1.457, for a preservative treatment that will add 2 years to the life of a 5-year timber costing $4.329 untreated, without increasing the cost per year. Any investment for treatment less than this difference means a corresponding cash saving.

Table III and Chart III combine the former tables and charts by showing how much is available or what can be spent for preservative treatment to obtain longer life for the timber.

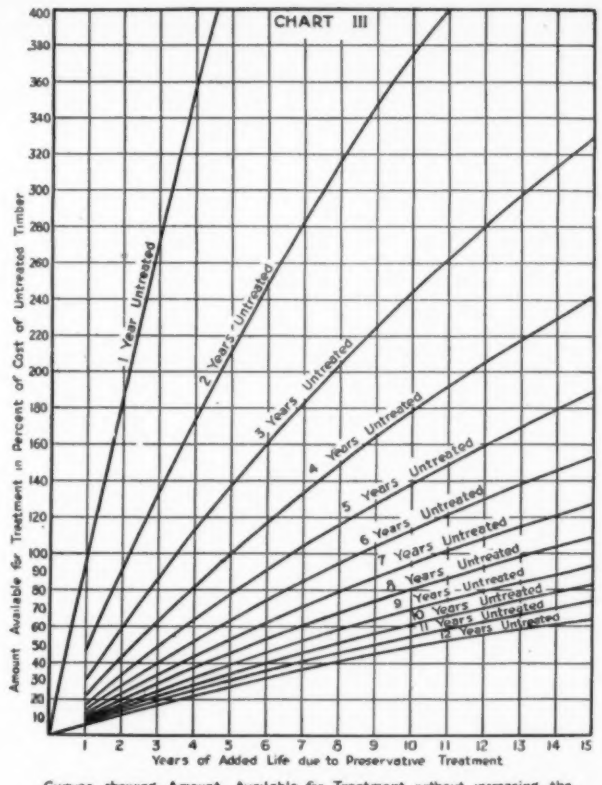
On Chart II the horizontal scale represents the number of years added to the life of untreated timber as a result of preservative treatment. The vertical scale repre-

TABLE III

Table of Amount Available for Treatment Without Increasing Annual Charge Expressed in Per Cent of Cost of Untreated Timber

Life Untreated Years	Years of Added Life Due to Treatment														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	95	186	272	355	433	508	579	646	711	772	831	886	939	989	1,038
2	46	91	134	173	211	248	282	315	347	377	405	432	458	483	506
3	30	58	86	113	138	161	182	205	225	245	263	281	298	314	329
4	22	43	63	82	100	118	134	150	164	179	193	206	218	230	241
5	17	34	49	64	78	92	105	117	128	140	150	160	170	179	189
6	14	27	40	52	63	75	85	95	105	113	122	130	138	146	153
7	12	23	33	43	53	62	71	79	87	95	102	109	115	121	127
8	10	19	28	37	45	53	60	68	74	81	87	93	98	104	109
9	9	17	25	32	39	46	52	59	64	70	75	79	83	88	94
10	8	15	21	28	34	40	46	51	56	61	66	70	74	79	83
11	7	13	19	25	30	36	41	46	50	54	58	62	66	70	74
12	6	11	17	22	27	32	37	41	46	49	52	56	58	61	64

sents the amount that can be spent to obtain such extended life without increasing the annual charge, expressed in per cent of the cost of untreated timber, or in cents for every dollar invested in untreated lumber. It will be seen that there are many cases in which one can afford to spend more for treatment than the timber cost originally. On Chart III there are 12 curves each representing timber with a certain life untreated. The only precaution to be observed in using the chart is to bear in mind that the scale at the bottom represents the years of life added as a result of treatment and not the total life of the treated timber.



Curves showing Amount Available for Treatment without increasing the Annual Charge Expressed in Percent of the Cost of Untreated Timber

Removal Charges

Up to this point we have dealt only with the annual charge necessary to pay for the cost and installation of the timber. There is, however, another expense connected with timber in structures that is sometimes overlooked. This is the renewal charge, or, as it might better be called, the removal charge, and it consists of the cost of removing old timbers before replacements can be made, together with any additional cost of installation above that of the installation of the original timber. It is customary to set aside a certain sum each year, so that at the time when the timber must normally be renewed, a fund will have accumulated which, with the interest, will be sufficient to cover this renewal charge. Here we have a different condition to meet, for instead of borrowing money on which we must pay interest, we are setting aside a sinking fund which earns interest. Naturally, the cost of renewing a treated timber is the same as that for untreated timber. The only element which affects this annual renewal charge is the frequency with which renewals must be made; the longer the life of the timber the more time we have to accumulate the necessary money, and consequently the smaller is the amount

TABLE IV

Annual Charge in Cents for Renewals Costing $1.00 and Recurring at Intervals of 2 Years to 25 Years

Years	Annual Charge	Years	Annual Charge	Years	Annual Charge	Years	Annual Charge
2	48.780	8	10.472	14	5.102	20	3.024
3	31.721	9	9.069	15	4.634	21	2.800
4	23.201	10	7.950	16	4.227	22	2.599
5	18.098	11	7.039	17	3.870	23	2.414
6	14.702	12	6.283	18	3.554	24	2.247
7	12.282	13	5.645	19	3.275	25	2.096

we must set aside annually.

Table IV gives the annual charge for renewals occurring with frequencies from 2 to 25 years at 5 per cent compound interest. The annual charges are expressed in per cent of the renewal cost, or in cents per dollar of renewal cost. These charges have further been put in the form of a curve, which appears at the bottom of Chart 1.

From this table it appears that renewals costing $1.00 and recurring every 5 years, cost 18.098 cents per year, while if the life is extended to 7 years, the renewal cost is reduced to 12.282 cents, a net cash saving of 5.816 cents on every dollar. This saving is in addition to any saving on the cost of the timber.

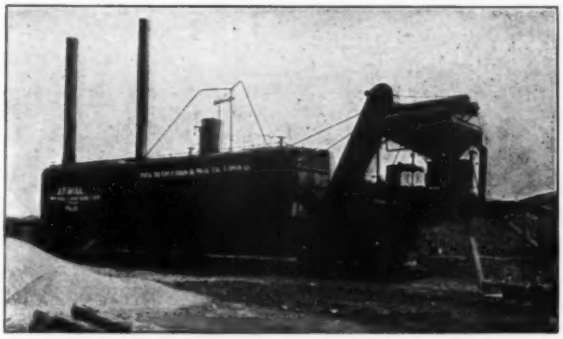
The chart for renewals is usually neglected in preliminary estimates, since it is as a rule only a small fraction of the total annual charge against the timber. It is, however, an item that should not be lost sight of, as there are many cases in structures where from inaccessibility or peculiarities of construction the cost of removing old timbers becomes formidable.

In most ordinary cases Chart III or Table III will be all that is necessary, since from these we determine "what the traffic will bear," or how much a man can afford to spend for treatment. This factor alone frequently determines what kind of treatment to recommend.

MAINTENANCE OF HIGHWAYS FREQUENTLY CALLS FOR INDIVIDUAL ATTENTION IN THE MAKING OF MINOR REPAIRS WHICH GREATLY LENGTHEN THE LIFE OF THE ROAD

New Asphalt Plant Shows Many Improvements

THE new Improved Merriman No. 3 One-Car steam melting asphalt plant manufactured by the East Iron & Machine Company, Lima, Ohio, is only 58 feet over-all and is the shortest complete railroad plant of its capacity on the market. With all this, the guaranteed capacity is 2,000 square yards of 2-inch topping, or 2,800 yards of asphaltic concrete, in a 10-hour day. Users of this plant are now laying over 3,000 yards of 2-inch topping in a 10-hour day.



THE NEW MERRIMAN ASPHALT PLANT READY FOR SHIPMENT.

The side sills are extra heavy girder construction. They are so constructed that they cannot sag or warp out of shape. The trucks are extra heavy, M.C.B. standard, with 6 x 11-inch journals, special hammered steel axles and chilled wheels. The arch bars are made of bar steel. The boiler is of the locomotive type, of 125 horse-power with a capacity of 160 pounds pressure. It is constructed under the state of Ohio and the A. S. M. E. specifications, and will pass the inspection bureau of every state. The engines are of simplified construction, very heavy, and all parts readily accessible.

Four melting kettles are used, and to insure compactness and solidity they are constructed in one unit. Each kettle is equipped with two steam coils, made of heavy electrically welded pipe. These kettles are so arranged that air pressure can be used to facilitate discharge of the asphalt, and so that either air or steam can be used for agitation. Clean-out doors are placed at close intervals.

The sand drum is of patented construction 4 feet 9 inches in diameter and 25 feet long. No internal spiders are used, and 4 heavy I-beams act as spill plates and carry the sand so that it falls through the heat as the drum revolves. Spiral flights carry the material forward. The drive end of the drum runs on trunnions and a riding ring, and is driven by means of gear segments around the outside of the drum. The capacity is greater than the material required for the rest of the units of the plant, and is approximately 25 tons per hour.

The mixer has a capacity of 12 cubic feet and is equipped with patented blades having renewable ends. This mixer is so arranged that the material can be dumped directly into motor trucks, which run under the mixer platform. The hot material storage bin is telescopic, and holds 12 cubic yards, or 15 tons.

When extended for operation, the working platform, on which the mixer is located, permits trucks and wagons to pass under the mixer dump. When packing the plant for shipment, it is easily drawn within shipping length of the car, and clears the end of the car frame.

Elevators on both sides of the plant feed the sand drum, so material can be stored on either or both sides. The hot material elevator is entirely enclosed in dust-tight sheet-steel housing, made in sections which can easily be removed to facilitate packing for shipment.

The fire-box is arranged for burning coal, coke, wood or fuel oil. It gives a choice of fuel at all times, thus saving a lot of trouble.

A Poet's Advice on Good Roads

In the office of the New York State Highway Commissioner in Albany, hangs this paraphrase of Longfellow's poem, a warning against the building of cheap roads:

"Hordes of autos now remind us
We should build our roads to stay,
And departing leave behind us
Kind that rains don't wash away.
When our children pay the mortgage
Father's made to haul their loads,
They'll not have to ask the question,
"Here's the bonds, but where's the roads?"

—*Baldwin Ledger.*

Miscellaneous Contract Hauling in Cleveland

Comparative Costs of Hauling Coal and Other Materials with 3½-Ton Units

By J. S. Ferguson
Hauling Contractor, Cleveland, Ohio

IN April, 1920, the writer bought a Selden 3½-ton truck. For the first 12 days it was engaged in hauling sand and coal, and the following 30 days it hauled coal and wire for the American Steel & Wire Company. From May 12 to 17 it hauled coal. Since then it has been working on the excavation for the Baldwin Reservoir just outside of Cleveland.

When hauling coal for the American Steel & Wire Company, 63 loads were handled in 16 days, the loads varying from 3½ to 3 tons. The truck was loaded with a clam-shell shovel, traveled over good city streets and dumped at its destination. Much time was lost in loading because the trucks would bunch up. When waiting, the engines were allowed to run idle, so that the truck made only 3.89 miles per gallon of gasoline. The coal was hauled to a point 6 miles away, making a 12-mile round trip. In addition, the truck made a 5-mile trip to and from the job each day, making the daily average 57.25 miles and the hauling cost $1.52 per ton, or 25.3 cents per ton-mile. If it had been possible to cut out the 10-mile extra trip each day, the cost would have been $1.38 per ton, or 23 cents per ton-mile.

Since May 17, 1920, the truck has been used on the Baldwin Reservoir job for hauling clay and shale, mostly the latter. The truck is loaded with clam-shell shovels, and while the dump body has a capacity of 3.6 cubic yards by actual measurement, it is heaped up so that the load is frequently 4 to 4½ cubic yards.

From the time the truck leaves the shovel until it is dumped, the drive is an up-hill pull over dirt roads. It is necessary to keep shifting from first to second and to third, but most of the work is done in first and second and it is never possible to get into fourth. The truck averages 20 miles a day on the job, and the cost is 27.9 cents per cubic yard, or 18.6 cents per cubic yard mile.

LOADING THE SELDEN WITH GRAVEL BY STEAM SHOVEL

On another job the truck was used 2½ days hauling material from a clam-shell steam shovel. The haul was over good pavements and level roads, and it was possible to run on high practically all the way. On this job 20 trips were made each day, traveling nearly twice as far and averaging nearly 6 miles per gallon of gasoline.

The actual repairs to date have been $98, averaging 2.3 cents per mile on the cost sheet. Figured on the National Standard Truck Cost System, it cost $21.53 per day to haul coal, and $23.78 per day to haul excavating material. Both figures include $7.50 per day for driver,

although the writer does the driving himself. The following table shows the complete analysis of operation records and cost records for the operation of the truck in general haulage of excavated material.

Subscribers who have not already carefully examined the National Standard Truck Cost System, can secure a copy free from the Contractors' and Engineers' Monthly

Analysis of Operation and Costs

Owner—J. S. Ferguson

Business—General Haulage—Excavated Materials

Address—Cleveland, O.

Truck Capacity—3½ Ton (A)

Operation Records

A—Total Period		B—Daily Averages	
1. Period covered	3½ Mos.	12. Round Trips	20
2. Days operated	92	13. Deliveries—Pickups	.....
3. Days out for Repairs	.....	14. Quantity—Out—Cu. yds	53
4. Total Round Trips	1840	15. Quantity—In	.....
5. Deliveries—Pickups	.....	16. Total Quantity—Cu. yds	53
6. Quantity—Out—Cu. yds	7360	17. Miles Traveled	60
7. Quantity—In	.....	18. Miles per Round Trip	3
8. Total Quantity—Cu. yds	7360	19. Quantity per Trip—Cu. yds	4.25
9. Miles Traveled	5520	20. Cu. yd.—Miles	129
10. Gasoline—Gals. used	1725	21. Miles per Gal. Gas	3.6
11. Cyl. Oil—Pts. used	548	22. Miles per Pt. Oil	10.1

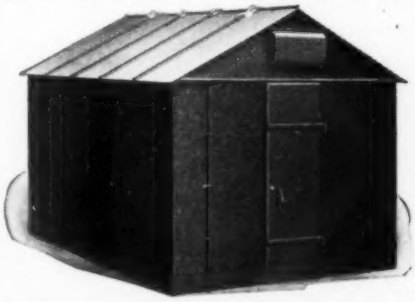
Cost Records

C—Investments		E—Variable Charges—Period	
23. Chassis	$3090.00	40. Fuel at 31 cts. Gal	$ 534.75
24. Body	305.00	41. Cyl. Oil at 7½ cts. Pt	41.10
25. Cab	85.00	42. Tires—5520 Miles	215.62
26. Painting	20.00	$ 386.70—10000 Miles Life	
27. Special Equipment—Hoist	345.00	43. Depreciation— 5520 Miles	278.21
28. Freight and War Tax	177.28	$4535.58—90000 Miles Life	
29.	.....	44. Maintenance and Repairs (Est.)	102.62
30. Total Investment	4022.28	45. Total Variable Charges	$1230.30
31. Tire Value	386.70	46. Driver's Wages	690.00
32. Total less Tires—to be Depreciated	4535.58	47. Total Fixed Charges	247.48
		48. Total Operation Cost	$2167.78

D—Fixed Charges—Yearly		F—Daily Costs	
33. Interest on Total Inv. @ 6%	$ 295.34	49. Cost per Day Operated	$ 23.78
34. Taxes and Licenses	48.00	50. Cost per Mile Traveled	.392
35. Insurance	234.70	51. Cost per Cu. yd. Hauled	.279
36. Garage Expenses	180.00	52. Cost per Cu. yd.—Mile	.186
37. Total Per Annum (300 days)	808.04	53. Repair Cost per Mile—Est	.023
38. Total per Month	67.34		
39. Total for Period—92 days	$47.48		

The Safe Storage of Explosives

THE storage of explosives and other combustibles, involving a grave menace to life and property, warrants the serious consideration of contractors, quarry foremen and others upon whom this responsibility may fall. Littleford Brothers, 500 East Pearl Street, Cincinnati, Ohio, manufacture both permanent and portable steel structures for the adequate protection of explosives and other inflammable materials in storage.



A SECTIONAL STEEL MAGAZINE FOR STORING EXPLOSIVES

The Littleford storage magazine, shown herewith, takes care of a minimum of 108 kegs of explosive material or a maximum of 1,848 kegs. The magazine is of a more or less permanent nature, but when removal to another location is desired, it is a simple matter to take it down and erect it where needed. It is made in sections, having grooved seam edges that interlock snugly. The sections are secured firmly in place by U-bolts to the interior steel angle framework, making the joints weather-proof. The framework consists of steel angles, and the covering is sheet steel 3/32-inch thick. The joists are heavy angle bars, inlaid with oak pieces, to which the floor is nailed. The ventilator in each gable is screened with wire on the inside. The door is hung on two heavy wrought-steel hinges, which extend across the door, forming hasps on the opposite side which are attached to staples. With this arrangement padlocks can be used, thus making a practically theft-proof magazine.

A PORTABLE SMALL POWDER MAGAZINE

The Littleford portable powder magazine, made to carry from 8 to 30 kegs, is made particularly for contractors who keep on hand only a limited amount of explosives. It is permissible in most places to keep this magazine on the sidewalk or near a building where the material may be used. The danger of explosion in the event of fire is minimized, as the magazine can be rolled away very readily on its steel wheels when desired. The heavy steel body is fitted with angle-iron bars with seams closely riveted. The cover overlaps at the side and the end and has strong hinges, hasps and staple. The magazine is painted inside and out with graphite paint.

A square-end box, as shown below, is also manufactured for lumbermen, contractors and quarrymen who wish a less expensive magazine, but one which is perfectly safe. This magazine has a capacity of 50 pounds, weighs 52 pounds and measures 20 inches long, 14 inches wide, and 12 inches deep.

AN INEXPENSIVE POWDER MAGAZINE FOR CONTRACTORS

Competition for Plan for Sewerage System, Chauny, France

THE American Committee, La Renaissance des Cités, has announced an interallied competition for a plan for a sewerage system in Chauny, France, in which American sanitary engineers are especially invited to join. La Renaissance des Cités, whose president is M. Charles Dumont, Reporter-General of the Budget, and whose membership includes some of the leading engineers, architects, and other technical men in France, is the chief agency aiding the destroyed communities of the war zone in scientific planning and permanent rebuilding. It has helped with the plans of more than 200 towns, including Rheims, and is being assisted by the American Committee in rebuilding Pinon as a demonstration of the possibilities of city planning for the benefit of the entire war area.

From the competition for Chauny's sewerage system, La Renaissance des Cités hopes to develop ideas which will be useful in many other manufacturing towns of medium size. The first prize in the contest is 10,000 francs, and the second 5,000. The time limit for submitting plans is June 10, 1921. The sketches and other documents needed by contestants may be obtained from the French headquarters of La Renaissance des Cités, 23 rue Louis-le-Grand, Paris, France, for 65 francs ($4.55 at present rates of exchange), of which 50 francs will be returned when the documents are sent back. Further details may be obtained from the American Committee, whose headquarters are at 248 Boylston Street, Boston, Mass., on request.

Among the prominent engineers connected with the Committee are Frederick H. Fay, Edwin Farnham Greene, Charles T. Main, and Edwin S. Webster of Boston, Professor George F. Swain and Professor George C. Whipple of Harvard University, Charles Saville of Dallas, Tex., George W. Fuller and E. P. Goodrich of New York City, and Harland Bartholomew of St. Louis.

The Care of Concrete Mixers

By L. P. Lessard

IF contractors would give their mixers the little attention that they require, they would last much longer. In most cases the operators are fully responsible for the up-keep of the machines and are never called to task because the mixer is in run-down condition. If the contractors themselves or a responsible foreman would see to it that their mixers were properly greased, oiled, cleaned, etc., there is no doubt that the mixer's life and efficiency would be materially increased.

Many building contractors do look after their mixers, and their machines reflect this care in their operation. Workmen, however, usually leave their mixer just as they finish with it. Only recently the writer saw two workmen one morning pounding the loading skip with sledge hammers, trying to clean it out, because they had neglected to wash it out the previous evening. Imagine the mixer going through this pounding process every morning and possibly more frequently. No wonder the mixer lasts only a short time and needs to be replaced.

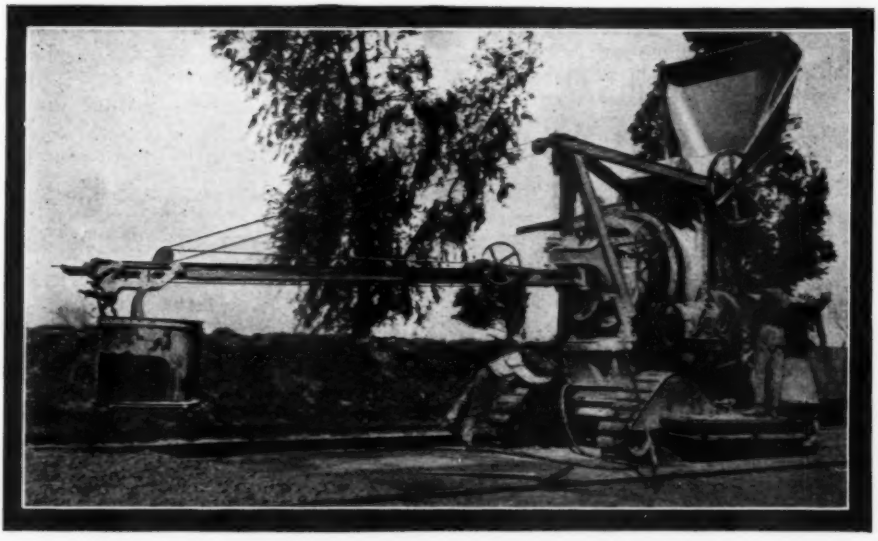
The following suggestions for taking care of building mixers are intended as an aid to those contractors who do not, but should, give their mixers careful attention. If followed carefully, good results will be noticeable in the looks and operation of the mixer.

Setting Up

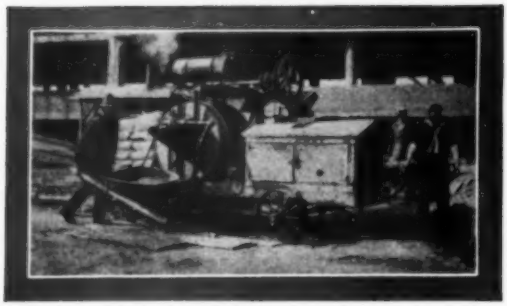
When you buy a new mixer, see that it is assembled correctly before starting. Turn down the grease-cups, oil the wearing surfaces where necessary, see that the bolts and nuts are tight and be sure everything is all right, then go ahead. Manufacturers always send instructions for setting up, which should be your guide when assembling.

Oiling

Oil your machine liberally. Give the drum rollers plenty of grease; they have the heaviest duty. Don't forget your engine, either; it needs oil. Follow the engine oiling instructions carefully. Oil the drive chains to make them drive smoothly and endure. Oil all gears, especially bevel gears. Use a good quality of machine oil that will



A CONCRETE PAVER EQUIPPED WITH BOOM AND BUCKET, TRACTION TREAD, GASOLINE ENGINE AND STEEL BALL-BEARING DERRICK



A NON-TILTING MIXER

not thicken when cold. Also use a good grade cup grease where grease is required.

Feeding

It has been found that, as far as mixing is concerned, it does not matter in what order materials are fed into the drum. The feeding is done to meet the convenience of the operator. If desired, the old method of hand mixing can be adopted, as follows: sand and cement, then add water and follow with crushed rock or gravel. A good way to get cement in without "dusting" is to put it into a barrow of sand, or, still better, to add some water to the batch before putting in the cement.

Where a sharp stone is used in the batch, it is well to put in a portion or all of the sand first, as the sand will act as a cushion and protect the shell of the drum.

Do not fill the drum too full. A big batch mixes more slowly than a small one. There is a happy medium between best time per batch and best quality, which experiment will determine. Cement mortar or "sloppy" concrete is best mixed in batches of reduced size.

Washing

Wash out the drum before the mixer is stopped. It is necessary to keep the inside of the drum clean, as only a clean drum will do good work. Fill the drum with water and revolve it until it is clean, then discharge the water. If water alone does not clean the drum, add a little crushed stone, or a few small pieces of scrap iron. If the drum is once neglected and cement allowed to harden inside, it is very difficult to clean.

Blocking

It is sometimes desirable to block mixers. Do this whenever possible. It not only prevents destructive vibration, but saves power and repair bills.

Care of Boiler

If you have a steam-driven mixer, follow these instructions carefully: Do not fire hard when the boiler is cold. The type of vertical boiler best adapted to concrete mixers has one weak point, namely, the top end of the flues is not surrounded by water. In raising steam, the fire should not be crowded until some pressure is shown on the gage, or the top of the tubes will be overheated and the boiler will surely leak. A boiler is really a sensitive apparatus and requires as much or more attention than the engine.

Repairs

Keep your mixer repaired. Don't allow parts to be worn so that they affect the operation of the mixer. The minute you notice a worn part, order a new one. It will pay you every time. Particularly watch your drum rollers. Replace them as soon as they are worn or become wabbly. Never allow your drum to run untrue. Watch every part and replace it with a new one as required.

Ordering Repairs

Always keep the repair lists which the manufacturer furnishes. Order your parts by numbers or according to the factory instructions. You will be surprised how much time it will save, and the sooner you get the replacement part on your mixer, the better for the mixer.

These simple rules, if followed carefully, will apply to any make of mixer. As a rule, manufacturers furnish instruction books which go into detail on each item, but if contractors will follow the above rules and use their own judgment about oiling, loading and taking care of their mixers, they will find that their mixers will give them better service and last much longer.

ACKNOWLEDGMENT.—Illustrations by courtesy of T. L. Smith Company, Milwaukee, Wis.

The Rich Contractor

"It is said that a certain contractor, well known throughout Ohio, who started out poor twenty years ago, has retired with a comfortable fortune of $50,000. This money was acquired through industry, economy, conscientious effort to give full value, indomitable perseverance, and the death of an uncle who left him $49,999.50."—*Exchange.*

A Portable Car Unloader and Storage Bin

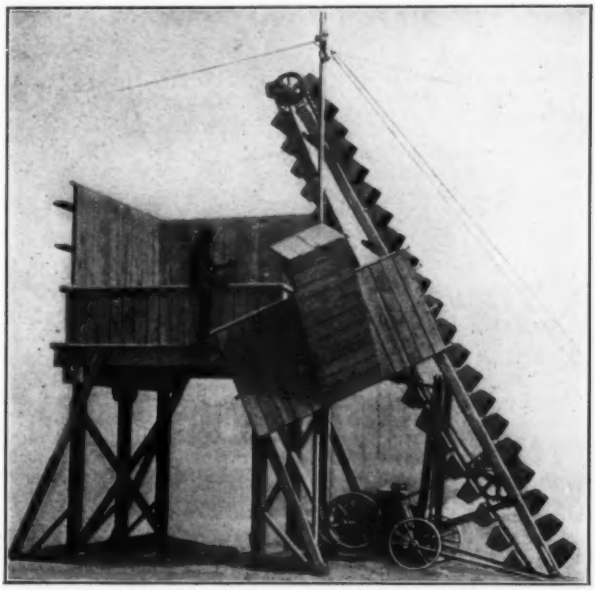
EVERY contractor knows that the two factors which eat big holes in profits on any job are hand labor and trucks that are not moving. When it comes to unloading material from cars onto trucks or wagons, slow hand shoveling is bound to hold up the truck, and when there are cars to move and no trucks on hand, it means unloading onto the ground and rehandling the load onto trucks. Here again the waste is multiplied, because the ordinary expense of loading wagons and trucks from the ground by hand labor is greater than the original expense of unloading the material from the cars.

The Fairfield Engineering Company, Lancaster, Ohio, has recently placed on the market an economical, speedy method of unloading from hopper-bottom cars directly into an elevated bin, from which the material is dropped into the truck or wagon. No skilled labor is required to operate these machines, and they are strongly built and should operate for years with trifling up-keep. With one of these portable outfits one man can unload 30 to 40 tons in an hour to an hour and a half. His work, aside from starting and stopping the machine, is merely to keep the material falling freely through the car hopper to the feeder and to clean up and move the car. The machine really does the work of 20 to 30 men and makes possible a saving of $8.50 to $9.50 in labor on every 50-ton car unloaded, taking into consideration transportation and erection costs, 20 per cent depreciation on the equipment, and power costs.

The track feeder is so made as to require only a small excavation beneath the railroad track, making special railroad supports unnecessary. This is an important feature because of the requirements of many railroads for special liability clauses in contracts for spur tracks where there are to be extensive excavations beneath any portion of them. The elevator is light-weight but amply strong, and sufficiently high to completely fill the loading bin. It is fitted with a two-wheel steel truck as part of its regular equipment, and a truck bracket to permit easy movement in connection with any wagon or motor truck. The bin holds 30 to 40 tons and can be filled within an hour by the elevator. Power is supplied by an 8-horse-power kerosene engine with friction clutch and a steel roller transmission chain.

If the machinery is to be located permanently in one location where electric current is available, it is usually preferable for power, and a 7½-horse-power motor of proper specifications with reduction gears and mountings can be used.

The bins, as shown in the illustration, are specially designed for this outfit and are built in sections, enabling them to be readily loaded and moved on trucks or wagons, for a quick set-up at the new location.



ERECTING THIS PORTABLE UNLOADER AND STORAGE BIN IS NOT A LENGTHY JOB

Maintenance Cost of Illinois Brick Roads

It cost the state of Illinois in 1919 $42.63 a mile to maintain 86.9 miles of brick highways, exclusive of roadside up-keep. Including this item, the total cost per mile was $118.79. Other total maintenance costs per mile ranged upward, above brick, from $149.86 to $334.80. Gravel and earth roads are not included in this statement.

Loading Device for Gravel and Crushed Stone

MECHANICAL means of loading gravel and crushed stone and other loose and heavy material are imperative for street departments and contractors in view of present labor costs, in spite of their slight reduction. The use of motor trucks has also brought about a condition which makes hand labor almost out of the question, because trucks must be kept in motion to be an economical part of the equipment of any street department or contractor. Under present conditions the demand is for large quantity and quick handling. The investment in trucks and other equipment is such as to demand speed and volume. Hand methods are archaic and not to be retained where machinery can be used to advantage.

A CONANT GRAVEL LOADER EQUIPPED WITH A FORD ENGINE FOR A CONTRACTOR WHO WANTED THIS COMBINATION

Conant gravel and sand loaders, manufactured by the Conant Machine Company, Concord Junction, Mass., are thoroughly developed machines, constructed of standard parts which are especially designed for this work, and tested with a wide margin of safety for the severest strains required under actual working conditions. They consist of a frame structure as illustrated, staunchly built of angle-bars and strongly braced and reinforced with gusset-plates at the corners. All intersections are hot-riveted, insuring firm joints. Wheels and running gear are usually of metal, but wood wheels for safe towing of machine long distances are sometimes furnished.

The elevating frame of the folding or collapsible loader is pivoted on a heavy shaft, enabling it to be lowered to go under 7½-foot beams or to be of not too great height when loaded aboard a truck for transportation some distance. The weight of the machine with the motor is 3,800, or with an engine 4,300 pounds. It is equipped with twenty 16 x 10-inch low-front malleable iron buckets with case-hardened digger-teeth. The overall height of the machine is 13 feet, the length 9 feet 6 inches, height of discharge from chute about 8 feet, wheels 50 inches and 25 inches high, with 4-inch tread, and it is made to dig at three levels, ground level, and 4 and 8 inches below ground level.

The State Highway Commission of Maine has nine of these machines in operation.

One contractor suggested that one of these machines be equipped with a Ford engine, in order to give additional power, and this scheme has worked out very well, as shown in the illustration.

The Secret of Good Hard Earth and Gravel Roads

The secret of a good hard earth or gravel road is, first, to make it good by proper grading; and second, to keep it good by preserving the grade and smoothing the surface. In many cases this last requirement has been very much neglected. Roads have been properly graded with the larger machines in the spring, and then allowed to get flat and rutty, and eventually go to pieces, for want of a little inexpensive but very necessary attention in the summer and autumn.

Suggestions for Asphalt Paving Contractors*

Part III

By Henry B. Drowne
Division Engineer with The Lane Construction Corporation

Rolling Equipment

VERY little road work can be done without the use of a roller. The 10-ton, 3-wheel steam roller is generally accepted as being the best type for general work. While the makers of rollers driven by gasoline motors claim many advantages for this type, the writer does not believe the three-wheel roller so driven will ever become popular. So many occasions arise on work where steam is desired, particularly in the case of methods using bituminous materials, that a steam roller is an absolute essential. Some of the best distributing machines could not be used except with steam traction; the necessity of heating asphalts with steam from the roller frequently occurs.

While it may be possible to roll pavements such as sheet asphalt or Topeka type with a three-wheel roller in the process of their construction, it is not usually done. A tandem roller is the best type of this kind of work, sizes of from 6- to 8-ton being the ones most generally used. There are several makes of rollers of both the three-wheel and tandem types, all essentially the same in design and operation. In the purchasing of a roller, facilities of service should be considered. Breakdowns will occur, and the ability to get repairs quickly and get the machine going again is an important detail.

ERIE TANDEM ROLLERS USED BY FRANK BARDELL, ASPHALT PAVING CONTRACTOR, BUFFALO, N. Y.

Care of Equipment

All new small tools upon receipt should be branded with the owner's name. Some contractors go so far as to paint the handles, but such an expense is hardly warranted. Sufficient tool boxes should be provided on work and at such points that upon quitting work the men can put the tools they are using in them. Many dollars' worth of tools are lost in a season if men are allowed to put the tools at night in other places than the tool box. An occasional inspection of small tools as to their condition, with the idea of having dull tools sharp-

* EDITORIAL NOTE.—The text is reprinted by permission, from Brochure No. 13 of The Asphalt Association.

ened and worn tools replaced with new ones, is advisable.

Tool boxes, wagons, rollers, and all other large equipment should be given a number for purposes of identification and record. The maker's number will suffice on plant which may bear such a number. For purposes of publicity, it is a good idea to place the company name on all plant, and on any plant that requires painting to use the same distinctive color scheme throughout.

A contractor doing a large amount of work necessarily has a large equipment. It is a prohibitive expense to bring all such plant together at some central point when not in use. The usual practice is to store plant locally at the completion of work and reship as needed from the different points of storage to the new work. Such a method is inexpensive and frequently makes a movement of plant on to new work very cheap where new work may be taken at a point near the vicinity of storage.

Tool boxes and small equipment should be put under cover for winter storage. It is also preferable to put wagons under cover. Where it is necessary to leave them in the open, if the bottoms are opened and the wheels raised so as not to be in the mud, the wagons will not be harmed even in a severe winter. At the end of the season, all wagons should be repaired and given a coat of paint, if necessary, and put in shape for next season's work. Frequent painting will add considerably to the life of any plant composed of wood. Gas engines and pumps should be thoroughly overhauled, replacing the worn parts with new ones.

Steam rollers, boilers, asphalt mixing plants, distributors, crushers, and other large plant are frequently difficult to get under cover for storage. Such plant, if left outside, by taking a few precautions will weather the winter without harm. With heavy plant, it is always advisable to choose a location for storage that will be accessible early in the following season.

All accumulations of dirt, rust and scale on an asphalt mixing plant should be removed after completing a job, and all metal surfaces should be given a coat of asphalt paint. The fire box under the drier should be examined and new bricks and grate bars replaced where necessary. All badly worn gears should be renewed. Kettles should be thoroughly cleaned out at frequent intervals while operating. When in operation, proper lubrication of bearings and gears does much to prolong their life.

Distributors of the two types that were described, to be used in connection with a road roller, need very little attention. When operating, the nozzles and screens should be frequently cleaned to prevent clogging. Accumulations of asphalt should be occasionally removed. Safety valves and gages should be cleaned and tested to see that they are in proper working order.

The Air Pumps Give Very Little Trouble

Any steam engine, whether on a roller or other piece of plant, needs frequent attention. Given good care, a steam engine will last for a long time, but a careless operator will ruin one in a short while.

Annual inspection of boilers by a properly qualified person is required in some states. When a contractor carries insurance on his boilers, annual inspection of them is made by employes of the insurance company issuing the policy.

The contractor who owns plant and fails to charge off anything for depreciation is fooling himself as to the amount of money he is making. There are a number of methods of calculating depreciation, the simplest of which being the one where the rate of annual depreciation is one divided by the total number of years of life of the machine in question. The life of some equipment is much longer than others. The use to which equipment is put, the care which is given it while operating it, the condition of repair it is kept in by the renewal of worn parts, are all factors which affect the life of any machine, or other equipment.

A contractor should at the end of each year examine his equipment and assign values to the different pieces of plant in order to determine the amount of capital actually invested. The difference in book values of the same plant from year to year will be the amount of depreciation. Money charged off for depreciation should theoretically be set aside and allowed to accumulate for the purchase of new equipment. The successful contractor, however, can make such money earn larger returns by using it in the business than by banking it, or otherwise investing it. In any event, it should be kept track of in the office records and never counted in with the profits.

A BUFFALO-SPRINGFIELD ROAD ROLLER EQUIPPED WITH PRESSURE-CYLINDER SCARIFIER

Organization and Planning

Some jobs will not move right, and ultimately may show a loss in spite of the fact that the contractor has everything in the way of plant equipment, ample resources, and fair prices on the work. In such an instance lack of success can probably be laid to poor organization as much as anything else. A good superintendent on the job is a prerequisite, and many contractors who undertake to superintend their own jobs make a miserable failure of it. The contractor is obliged to leave a good deal of the detail of construction to his superintendent. Contingencies will arise that require a modification or change of any prearranged plan, and the superintendent must adopt such a change on his own responsibility.

As a superintendent is continually coming in contact with the residents in the neighborhood of the job, it is worth a good deal if he is a man of diplomatic trend. If he hasn't such a trait, the contractor can well afford to spend some time in trying to impress him with its importance. The tactful superintendent is often able to make arrangements for materials or set-ups that save money, while the superintendent who possesses the faculty of rubbing people the wrong way often causes the contractor a lot of unnecessary trouble. A contractor's reputation is based on the results he delivers, and a reputation for doing good work in an efficient manner is a valuable asset for any contractor to have.

A contractor's reputation is largely in the hands of the organization actually performing the work. It takes time to build up an organization of superintendents, foremen and engineers who are worth while. A contractor should observe closely the work of his men, and the undesirables should be dropped. Those that are worth while should be given an incentive to stay. Some men in any organization are brighter than others. Selecting such men and giving them more responsibility and observing how they perform their new duties may result in placing them in charge of work either as foremen or superintendents. Men brought up from the ranks in this manner usually have a sense of loyalty and appreciation that otherwise would be lacking.

Planning and coördination of work are of extreme importance in the successful accomplishment of highway construction. The type of work and the size of the job determine the kind of equipment that is necessary. The time in which the job must be completed and the availability of plant will influence its selection, and the

amount of labor required will depend upon the methods adopted. If advantage can be taken of some particular method of the manipulation of material, the economy of such a method should be considered with relation to the new and special equipment that it might require. Buying special equipment that is not suitable for general use on work is usually inadvisable.

When the methods to be used have been determined, a progress plan of the work should be made. The need of plant and materials necessary for the work should be anticipated far enough in advance so that no delays will occur for lack of them. A well-defined plan of progress will enable the contractor to keep the different parts of the work more closely coördinated than if no such plan is made. A daily report of progress may be made. The report should show each day the total of the work performed to date. By comparing these reports with the progress anticipated, the work can be speeded up where necessary, or the original plan modified to suit the conditions which prevail. Another valuable feature of this report is the listing by car number of the material imported by rail. Material which is slow in arriving can be traced and rushed, and one only has to look at the last report to learn the whole situation. Careful planning will prevent having so many laborers on work that they cannot work to advantage because some other part of the work is held up for a cause that could have easily been foreseen.

Many of the items of work done on a highway contract are difficult of exact measurement until the final survey is made. The daily expense on the job should be kept and classified into as many divisions as the contractor may desire. There should be at least as many subdivisions as there are items in the contract, and sometimes it is advisable to make further subdivision. To illustrate, the following table is given, which shows on the left side the contract quantities and on the right side the subdivisions that might be made in classifying the costs.

Contract Headings	*Headings for Cost Classification*
28,500 sq. yds. grading	Grading
28,500 sq. yds. 2-inch Topeka	2-inch Topeka Plant repair Asphalt Filler Sand Stone Mix Haul mix Lay mix Roll mix Coal and oil
1,375 cu. yds. sand filler	Sand filler
5,652 tons trap rock	Trap rock Stone at car Load Haul Spread Roll Coal and oil

A superintendent can roughly estimate the daily output on the different parts of the work and from his classified expense arrive at the unit costs of the work. The frequency with which the daily classified costs should be sent to the office is optional with the contractor. While some prefer to know the total expended each day, others do not require the classification costs to be submitted except with the pay-roll, which may be once a week or once in two weeks. A superintendent should approximate his unit costs from day to day. The need for checking up the cost of work oftener than every one or two weeks is not so essential in the case of superintendents in whose ability the contractor has the utmost confidence, as it is in the case of superintendents who are not so proficient.

If a contractor has certain rules or methods which he wishes followed in conjunction with the work, it is advisable that he prepare a set of instructions covering them and put it in the hands of each superintendent. Much confusion will be avoided by doing this, and there should be no excuse on the part of the superintendent for his failure to comply with the written instructions. Written work and reports of superintendents if made on printed report forms furnished by the office, will facilitate the recording and filing work of the office in a marked degree.

For Engineers

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

For Contractors

SPREADING BITUMINOUS LIQUIDS
The Kinney Mfg. Co., 3529 Washington St., Boston, Mass., will be glad to send to contractors and municipal officials a copy of its catalog describing its patent combination auto heater and distributor for heating and applying under pressure all varieties of bituminous material for road construction, maintenance or dust laying.

TRACTORS FOR HAULING LAND LEVELERS
A worthy combination outfit for contractors and road commissioners, consisting of a 5- or 10-ton Caterpillar tractor hauling blade graders, is described in detail in one of the catalogs of the Holt Manufacturing Co., Peoria, Ill.

MOTOR TRUCK PERFORMANCE
The performance of Mack trucks for contractors in all kinds of work is described in the literature of the Public Works Department, International Motor Company, New York City.

CENTRIFUGAL PUMPING MACHINERY FOR WATER-WORKS
Bulletin H-4, published by the Lea-Courtenay Co., 14 Maine St., Newark, N. J., describes in detail this company's pumps, both for water-supply and standard fire service.

COPYING MAPS AND TRACINGS
The Lithoprint Co. of New York, Inc., 41-43 Warren St., New York City, will be glad to send to contractors a copy of its booklet describing the Lithoprint for making permanent copies of ink prints on paper, cloth or tracing cloth which are true to scale, at moderate expense.

PORTABLE HEATING EQUIPMENTS
Littleford Bros., 500 East Pearl St., Cincinnati, O., manufacture an extensive line of portable heating equipment for contractors and municipalities. Those described in its literature include tar heaters, fire wagons, tool heaters, lead furnaces, mastic heaters, gravel heaters, petroleum heaters, asphalt heaters and distributing tanks and pouring pots, and asphalt paving tools.

PAVING ASPHALT
The Standard Oil Co. of Ind., 910 S. Michigan Ave., Chicago, Ill., has published a booklet, "Standolind Paving Asphalt," which contains valuable information regarding the building of asphaltic roads. It may be secured free by contractors and engineers on request.

ROAD-BUILDING EQUIPMENT
The Universal Road Machinery Co., Kingston, N. Y., will be glad to send its catalog and prices covering Reliance road-building and quarry equipment, including crushers, elevators, screens, scarifiers, car unloaders, etc., to contractors and engineers interested.

WHY STERILIZE WATER?
This is the title of a book published by Wallace & Tiernan Co., Inc., Newark, N. J., engineers and contractors, engaged in water-supply work, as it contains valuable information regarding sterilization of municipal water-supplies to prevent water-borne epidemics.

BITUMINOUS CONCRETE PAVEMENTS
Full information regarding Warrenite-Bitulithic pavement, which is a true bituminous concrete pavement of the mixed type, is given in detail in the illustrated booklets of Warren Bros. Co., Boston, Mass.

HIGH EXPLOSIVES
A 104-page booklet containing complete information on the various kinds of high explosives, which will be valuable for anybody who has to make use of explosives in his work, may be secured from E. F. Carley, Explosives Division, E. I. Du Pont de Nemours & Company, Wilmington, Del.

STREET AND PARK LIGHTING EQUIPMENT
The Westinghouse Electric and Manufacturing Co., Illuminating Engineering Bureau, located at the George Cutter Works, South Bend., Ind., will be glad to coöperate with any lighting contractor or engineer in any prospective street lighting installation. Full information regarding Cutter standards and tops may be secured by writing to this company.

CLEANING WATER-MAINS
The National Method for cleaning water-mains and making them equal to their capacity when new is described in the literature of the National Water Main Cleaning Co., Hudson Terminal Building, New York City.

CERTAINTY IN MOTOR TRUCK HAULING
A catalog prepared especially for contractors, describing the uses, value and dependability of motor trucks in general contracting and hauling, may be secured by writing to the Packard Motor Car Co., Detroit, Mich.

MAKING BLUE-PRINTS
Contractors and construction engineers who have frequent need of blue-prints should get in touch with Wickes Bros., 370 Water St., Saginaw, Mich., and get this company's booklet regarding the Wickes blue-print machine, which makes prints up to 48 inches in width and of unlimited length.

DURABLE DRAINAGE CULVERTS
Full details regarding the long life and rust-resisting qualities of Newport corrugated metal culverts will be found in the latest literature of the Newport Culvert Co., 542 West 10th St., Newport, Ky.

ECONOMY IN CONCRETE MIXING
Bulletin 104, published by the Ransome Concrete Machinery Co., 1772 Second St., Dunellen, N. J., describes in detail its mixers for concrete road work.

EXCAVATOR CRANES
The Excavating Machinery Division of Pawling & Harnischfeger Co., Milwaukee, Wis., will be glad to send catalogs describing the uses and service of P. & H. excavator cranes equipped with clam-shell buckets with hook for magnet or sling chain and scraper buckets.

EFFICIENT TAR KETTLES
Thirty styles of tar kettles for street and road work are described in the catalog and price list of Connery & Co., Inc., 4000 N. 2d St., Philadelphia, Pa.

CALCIUM CHLORIDE FOR PRESERVING ROADS
Dow calcium chloride flake, such as is used by some state highway departments for preserving gravel and macadam roads, is described in detail in the literature of the Dow Chemical Co., Midland, Mich.

MAINTAINING ROADS WITH ONE MAN
The best way for maintaining dirt roads with a one-man patrol is explained in the literature of the Avery Co., Peoria, Ill., which describes this company's one-man "Road-Razer" or road maintainer.

(*Continued on page* 64)

Continued from page 63

OIL-BURNING CONTRACTORS' EQUIPMENT
The Hauck Manufacturing Co., 132 Tenth St., Brooklyn, N. Y., will be glad to send its special bulletins on lead-melting furnaces, asphalt surface heaters, kettle heaters, lights, kerosene torches, forges and concrete heaters to interested contractors on request.

QUICK-ACTING CLAM-SHELLS
Contractors interested in securing a bucket with lubricated, grit-proof main bearings, should write to the Owen Bucket Co., 418 Kirby Building, Cleveland, O., and ask for a copy of the Owen literature.

FREE DATA ON GRANITE PAVING
The Granite Paving Block Mfrs.' Assoc. of the U. S., Inc., 31 State St., Boston, Mass., will be glad to send to contractors and engineers copies of its specifications and literature regarding the use of granite for paving and curbing.

PUMPS FOR ROAD WORK
In an interesting booklet entitled "Watering Down the Road" the C. H. & E. Manufacturing Co., 384 Clinton St., Milwaukee, Wis., describes in detail its gasoline-driven Simplex pumps for furnishing water for road jobs from a distance.

COMPUTING CONTRACT ESTIMATES
The value of a calculating machine in figuring payrolls, contract estimates, earth work, pipe discharge, etc., is described in detail in the booklet, "The Monroe and the Engineer," which may be secured from the Monroe Calculating Machine Co., Woolworth Building, New York City.

WATER-WORKS CHEMICALS
The Mathieson Alkali Works, Inc., 25 West 43d St., New York City, manufacture pure anhydrous liquid chlorine, chloride of lime and soda ash for water-works service. Literature and prices or any or all three of these products may be secured free on request.

DOUBLE-ACTING PILE HAMMERS
The McKiernan-Terry Drill Co., 19 Park Row, New York City, manufactures double-acting pile hammers which have been found particularly successful by contractors. The literature of this company, which may be secured on request, contains interesting data regarding the uses of these hammers.

LONG-LIVED WATER PIPE
The U. S. Cast Iron Pipe & Foundry Co., Burlington, N. J., has issued some illustrated literature on the length of service of cast iron pipe for water-mains, which will be of interest to contractors and engineers in this field.

INTERNAL COMBUSTION LOCOMOTIVES
Record No. 95, issued by the Baldwin Locomotive Works, Philadelphia, Pa., contains complete descriptions and illustrations of the uses of Baldwin internal combustion locomotives on industrial railway service.

ROAD-BUILDING MACHINERY
The J. I. Case Threshing Machine Co., Racine, Wis., has published a booklet describing its steam and kerosene tractors, road rollers, graders, rock crushers, scrapers, stone screens, bins, drags, rooters, etc., which may be had on request.

HOW TO SPEED UP GRADING
When the light-weight tractor can do the work of three or four teams on a grading job it is time for the contractor to sit up and take notice. The literature of the Cleveland Tractor Co., 19211 Euclid Ave., Cleveland, O., describes just such work being done by Cletracs, in addition to giving the specifications of this machine.

ROAD MACHINERY OF EVERY SORT
Complete data and catalogs of the Austin-Western Road Machinery Co., including graders, steam rollers with scarifier attachments, and all necessary road-building equipment, may be secured by writing to the Austin-Western Road Machinery Co., Chicago, Ill.

FREE SAMPLE OF STAND-PIPE PAINT
The Tropical Paint and Oil Co., Cleveland, O., will be glad to send to contractors, public officials and others interested in preservative paint for stand-pipes and other steel structures exposed to the weather, a simple test of Elastikote demonstrating the non-crack feature of this preservative coating, which is prepared to withstand conditions which would destroy ordinary paint.

APPLICATION OF THE CEMENT GUN
Bulletin 122 M, issued by the Cement-Gun Co., Cornwells, Bucks Co., Pa., describes in detail the application and uses of the Cement-Gun in mine work, in relining concrete reservoirs and repairing other concrete structures which have become damaged or eroded by the weather.

PORTABLE UNLOADERS AND STORAGE BINS
A method for cutting the handling cost of unloading cars with sand, gravel, slag, etc., is described in the literature of the Fairfield Engineering Co., Lancaster, O., which illustrates the use of the Fairfield portable car unloader.

TRUCKS FOR ROAD MAINTENANCE
Any contractor with hauling requirements for road building, general contracting or other work, should secure the latest literature of the Winther Motor Truck Co., Kenosha, Wis., containing details and specifications of these heavy-duty, all-round service trucks.

CONCRETE MIXERS FOR PAVING AND SIDEWALKS
The special concrete mixers made by the Jaeger Machine Co., 215 Dublin Ave., Columbus, O., for paving and sidewalk work, are described in detail in the latest literature of this company.

LAYING ASPHALT MACADAM ROADS
One of the latest booklets of the Asphalt Sales Dept. of the Texas Co., 17 Battery Pl., New York City, deals with building Texaco asphalt macadam roads. The book covers the subject from A to Z.

STEEL FORMS FOR ROAD WORK
The use of steel forms has materially speeded up the rate of laying concrete roads. If you are interested in being among those who are collecting bonuses on concrete road work write to the Heltzel Steel Form & Iron Co., Warren, O., and get a copy of its latest illustrated bulletin describing Heltzel steel forms.

WATER METERS THAT MEET THE DEMAND
The printed matter of the Union Water Meter Co., Worcester, Mass., describes in detail the King meter, designed to meet the demands of all water department service.

STEAM SHOVELS OF ABILITY
When a contractor has a dirt-moving job on hand and is looking for the best combination of machinery to help him, the literature of the Marion Steam Shovel Co., Marion, O., will help him in deciding on the steam, gasoline or electric shovel which he can use most effectively.

ALL TYPES OF HOISTING ENGINES
The new catalog of the National Hoisting Engine Co., Harrison, N. J., contains complete information regarding National hoisting engines for every purpose, from the smallest to the most powerful, either steam, gasoline or electrically-driven.

INDUSTRIAL CARS SAVE TIME
In many road-building jobs the use of industrial cars saves much time and money. The bulletins of the Koppel Industrial Car & Equipment Co., Koppel, Pa., describes the advantageous details of Koppel cars, trucks, etc., which are used very generally.

CONCRETE—ITS MANUFACTURE AND USE
The Koehring Co., Milwaukee, Wis., has just issued a handy-size, 208-page, cloth-bound book bearing the above title, which it will be glad to send to contractors interested in the manufacture and use of concrete. This book contains many valuable tables regarding concrete in road construction, bridge work, walls, sidewalks, silos and bins.

THE SERVICE OF WIRE GLASS
The Mississippi Wire Glass Co., 220 Fifth Ave., New York City, has just issued a 32-page, 4 x 8½-inch booklet describing the various types of wire glass which it manufactures, together with data regarding its service, thickness, sizes and weights.

AUTOMATIC LOWERING JACKS
The Duff Manufacturing Co., Pittsburgh, Pa., has just issued a new catalog describing its automatic lowering jacks, which should be of interest to contractors, particularly those engaged in bridge work. This company also manufactures the well-known Duff trench and excavation braces which permit speedy installation of sheeting in trenches and eliminate the danger of accidents.

PEDESTAL CONCRETE PILES
Full information regarding the value and advantages of pedestal concrete piles for foundation work, particularly in poor soil, may be secured by writing to the MacArthur Concrete Pile and Foundation Co., 12 John St., New York City.

ASPHALT PAINT
The "Genasco Paint Book," issued by the Barber Asphalt Paving Co., Land Title Bldg., Philadelphia, Pa., contains many interesting facts regarding the use of the various Genasco paints for special services to protect metals and concrete from corrosion and pitting.

CONTRACTORS', ENGINEERS' AND MANUFACTURERS' NOTES

New England Road Builders Association

The New England Road Builders Association, recently organized with temporary headquarters at Room 605, 68 Devonshire Street, Boston, Mass., should prove a beneficial and valuable organization in highway work throughout New England. The present officers are: Ransome Rowe, President; John F. Coleman, Vice-President; Jos. A. Tomasello, Treasurer; Frederick Hoitt, Secretary. The purposes of the organization as stated in the constitution are:

"The objects of this Association shall be to harbor the interests of those engaged in the construction of roads and work incidental thereto; to promote better relations between private owners and public bodies on one hand and contractors on the other; to combat unfair practices; to encourage methods which relieve the contractors of risks in bidding and contracting for work; to encourage efficiency among road builders; and to encourage sound business methods; in all lawful ways to promote and protect the business interests of the members of this Association; but there is no intention nor shall there be any action on the part of this Association to control, or in any way deal with prices or restrict competition."

The membership is divided into two classes, namely, represented members, comprising actual road building contractors, and associate members, comprising material and equipment men and affiliated interests. The fees are the same for both classes of membership and are $50 for admission and $5 per month dues. The Association is issuing a weekly bulletin containing information of interest to its members, covering the advertising of contracts for road construction in New England, and giving information and reports regarding prospective lettings.

Sanborn Moves Office

James F. Sanborn, Consulting Engineer, formerly located at 37 West 39th Street, New York City, has moved to Room 1862, 50 Church Street, New York City. Mr. Sanborn was Division Engineer on the Catskill Aqueduct, New York Water Supply, in charge of work in the Northern Aqueduct Department, and later in the City Aqueduct Department, where he had charge of putting the aqueduct into commission for use after the work was completed in 1916. Since 1919 Mr. Sanborn has been engaged in consulting engineering practice in the United States and for a time in the Dominican Republic.

Banquet for Ridgway

A large number of friends of Robert Ridgway, former engineer of subways, New York City, gave an banquet in honor of Mr. Ridgway's appointment as Chief Engineer of the new Transit Commission of New York City on June 9, at the Pennsylvania Hotel, New York City. Among the prominent speakers were Geo. McAneny, John H. Delany, Judge Edward A. McCall, and John F. Galvin. J. Waldo Smith, Chief Engineer, Board of Water Supply, was toastmaster. The invited guests included Leroy T. Harkness, Major-General O'Ryan, Daniel Ryan, Alfred Craven, Daniel L. Turner, and William Barclay Parsons..

Founder of T. L. Smith Company Dies

On April 29 Thomas L. Smith, founder, director and chief stockholder of the T. L. Smith Company, Milwaukee, Wis., died at his home in that city. Mr. Smith brought out a number of successful inventions during his life, the best known of which is the Smith tilting mixer.

Reduction in Sales Prices

The Standard Scale and Supply Company, 1631 Liberty Avenue, Pittsburgh, Pa., has announced a drastic reduction in the selling price of its street and road pavers. The new prices which this company has announced are down to the pre-war level of 1914. This reduction includes its 10-cubic-foot paving mixers, equipped with steam engine and boiler, boom and bucket, forward and reverse traction, hand steering device, brake, etc.

Prominent Advertising Company Changes Name

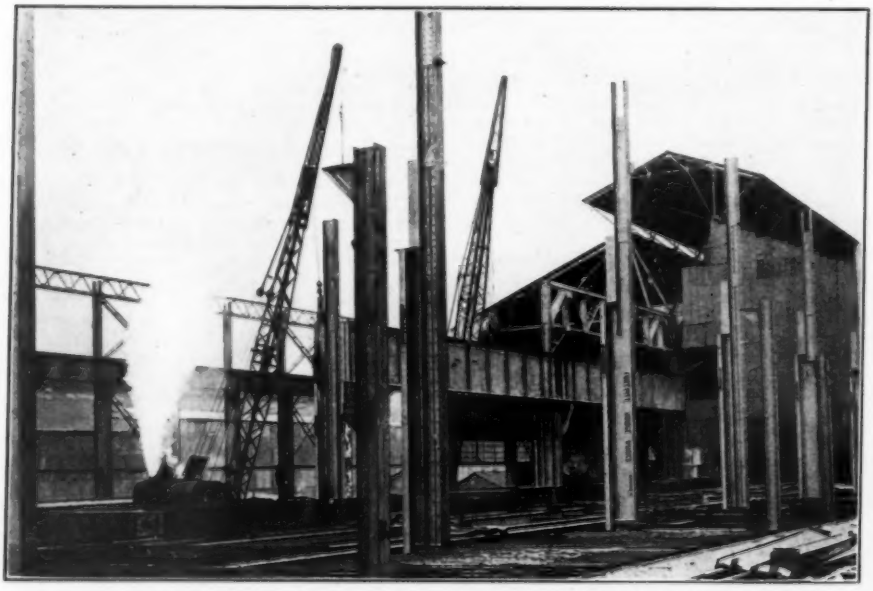
The corporate name of the well-known advertising agency, Rickard & Sloan, has been changed to Rickard & Company, Inc. The officers of the organization are W. L. Rickard, President, O. S. Tyson, Vice-President, Julian Gran, Treasurer, L. F. Maher, Secretary. Among the many clients of this company the following are well known in the field of contractors' machinery: the Easton Car & Construction Company, the Hayward Company, the Pulsometer Steam Pump Company, and the Waterbury Company.

Lecture by W. & T. Representative

C. A. Jennings, district representative at Chicago of the Wallace & Tiernan Co., Inc., Newark, N. J., manufacturers of chlorine control apparatus for water and sewage sterilization, on May 5 gave an illustrated lecture before the engineering students of Valparaiso University, Valparaiso, Ind., on the subject, "The Uses of Liquid Chlorine as Applied to Sanitary Engineering Processes."

Dirt- and Material-Handling Machinery

BUCYRUS SHOVEL IN ACTION IN LARGE CUT ON LIBERTY ROAD, BALTIMORE, MD.



TWO INDUSTRIAL LOCOMOTIVE CRANES EQUIPPED WITH 110-FOOT BOOMS, PLACING A 42-TON GIRDER 30 FEET FROM CENTER LINE OF TRACK AT THE OPEN HEARTH, U. S. STEEL COMPANY, CANTON, OHIO

Mule vs. Tractor in Grading

THREE MULES FIND IT ALL THEY CAN DO TO MOVE THIS LOADED FRESNO

Photographs courtesy of Cleveland Tractor Company

A TRACTOR RUNS AWAY WITH THE LOADED FRESNO WITH PERFECT EASE

Reinforcing Concrete Roads

Reinforcement and Expansion Joints Important to Life of Road

ONE of the most important features in concrete road construction is the reinforcement which prevents the formation of unsightly cracks due to settlement, contraction and traffic. It has been generally affirmed that reinforcement should be in the nature of a mesh with greater area of reinforcement extending across the width of the pavement and also with sufficient transverse reinforcement. It should not require special fasteners and should not be displaced by the pouring of the concrete or by other means. Loose rods are undesirable because of the expense of placing and tying.

A SECTION OF THE ALLENTOWN-EASTON, PA., CONCRETE ROAD

The entire road is 12½ miles long, 16 feet wide, 6 inches at edge, 8 inches at center. An interesting feature of this road is that the concrete mixers were turned a full 90 seconds to the batch. The result was a very uniform mix, which worked very easily as it was placed in the road and finished

The Truscon Steel Company, Youngstown, Ohio, has developed the Kahn road mesh, which is manufactured by a cold-drawn process from one-piece metal plates. It provides a taut reinforcement which is free from kinks and waves, and has proved very satisfactory on the many road jobs on which it has been used. It is quite easily handled because it is delivered in flat sheets.

There is also a Kahn armor plate with bevelled edge which furnishes an adequate expansion joint. The plate is made with sufficient depth and weight to secure a firm, solid anchorage to the concrete slabs, and is scientifically designed to protect the wearing edge of the expansion joint. The bevelled edge of th plate eliminates the square corner of the concrete and produces an obtuse angle in the concrete back of the plate. This prevents spalling and chipping of the concrete. The plate itself is rolled from dead, soft, open hearth steel of sufficient hardness to permit its wearing down with the pavement.

A device is furnished by the Truscon Steel Company for installing these plates, so that they may be placed exactly where they belong. The device consists of a supporting T-bar, which rests on the side forms. This bar is entirely above the top of the armor plate, so that the pavement can be finished evenly over the level of the plates without interference. The clamps suspended from the T-bar are adjustable in length so as to provide absolute accuracy in the crown of the plate. In this way the same installing device may be used on roads of any crown, as the clamps can be adjusted as desired. The armor plates, with asphaltum felt or elastic between them, are clamped closely together by means of the bevelled edge. The steel stools at the end of the T-bar hold it rigidly in place at the required level and rest on the side forms of the road. The stools can be moved to other locations along the T-bar, so that the installing device can be used for several widths of roads. The entire assembled joint can be raised or lowered by adjusting bolts in the supporting stools, assuring absolute accuracy of alignment of plates with the finished pavement. Many contractors who are using this new installing device are enthusiastic about it, owing to its simplicity and accuracy in use, as well as the ease in finishing the surface.

The accompanying illustration of the Allentown-Easton Road shows the fine condition of the pavement in which Kahn armor plates were used. The inspector for the Pennsylvania State Highway Department on this job stated that by exercising ordinary care the installation devices will function admirably, and the joints on the finished road are far easier under traffic where Kahn armor plates were used.

Road-Building Organization

Some Contractors Do Not Appreciate the Need and Value of Careful Planning for Road Jobs

THE financial success or failure involved in the execution of any extensive road improvement depends to a surprisingly large extent on the proper equipment and management of the working force. The problem of the engineer or contractor is to take a varying number of heterogeneous units, consisting of men, animals, machines and implements, and so arrange and direct them that each will fit in and form an integral part of a smoothly and efficiently functioning whole, which shall be peculiarly adapted to the execution of the job in question. This involves more than the mere knowledge of physical laws and mechanical coefficients. It involves the ability to direct and apply the human element of labor as efficiently as the engineer ordinarily applies the laws of physics to the efficient functioning of his machines. The engineer must in the future devote more attention to human engineering, as here lie almost unlimited possibilities. The Chinese coolie receives only 10 to 20 cents a day, and yet the cost per ton-mile for transporting produce is higher in China than in this country. This is not due to any lack of physical power or ability on the part of the workman, but entirely to his lack of proper direction and labor-saving equipment.

Probably at least one-half of the losses in road work are due to inefficiency in labor management. Dissatisfied and poorly-equipped workmen invariably mean a high labor turnover and low efficiency. It costs money to train a working force. This should be recognized by a bonus or a gradually increasing wage scale. Furthermore, willing and ambitious workmen and foremen mean a larger daily output. This has been accomplished in many places by means of fairly apportioned bonuses, so that each worker shall have a direct personal interest in advancing the work. This is possible only where the managing officials gain and retain the full and complete confidence and respect of the workers. A thoroughgoing, yet simple and readily understood, system of bookkeeping and cost accounting, which must be open to their full inspection, is a fundamental prerequisite. The greatest difficulty with the bonus system has always been to prevent a suspicion on the part of the workers that the contractor is not square or is profiting unduly through their own additional exertions. The fair and square contractor need never have any fear that definite knowledge on the part of the workers as to his exact profits and losses will prove one-half as harmful as the rumors of blind ignorance.

Proper Equipment

Another important source of loss is the lack of proper equipment. In part this is due to the too prevalent custom of letting road work in too small jobs. The purpose, to encourage a large number of local contractors to bid, is laudable, but in practice it works out otherwise. The small contract seldom warrants the introduction of up-to-date equipment or the adoption and development of new methods. The possible financial rewards are too small to spur the contractor on to the new methods, and he is content to continue with the equipment available and proceed along the old, well-established lines, where profits are measured, not by skill, ingenuity and inventive genius directed toward securing greater efficiency in ways and means of doing the work, but by shrewdness in guessing as to the prices on which the contractor places his bid. Furthermore, the cost of providing the highly specialized equipment necessary for much of our road work and of building up an effective organization is so great that the small contractor is unable to assume the burden. This is financially warranted only by one who has adequate assurance of continuous occupation for a considerable period of time. Consequently, the work, to be done really efficiently, must be done either by large contract or else by the county or the state. Smaller units, as the township or district, seldom have sufficient road work to warrant an up-to-date construction organization and equipment.

In providing new equipment the probable amount of time during which it will be idle must be taken into consideration. So far as possible, capital should be invested only in

productive plant. To tie up capital in plant which will be unproductive a large portion of the time or for long periods is justifiable only where the item in question will, during the period of its use, add so greatly to the efficiency of the total plant that the cost can be largely or entirely written off.

Magnitude of Task

To plan, lay out and carry on the work in a really efficient manner is no easy task. Take, for example, the construction of a concrete road. Here are involved the large number of operations which must be properly synchronized and correlated in order to secure the best results. First of all, the grading and drainage structures must be completed sufficiently ahead of the surfacing in order not to interfere with any of the numerous operations. Furthermore, it is necessary that the mixer be kept running most of the time. This requires that repair parts be kept on hand and that all materials be on hand and supplied as necessary; that orders for stone, sand and cement be placed in advance and with parties able to supply the maximum demand; and that adequate reserves be provided to tide over probable delays in delivery. The entire routing of each material from the receiving point must be carefully traced and all unnecessary handlings eliminated, and each operation must be studied in regard to equipment and methods employed, as well as to the non-interference of the several operations.

Before work is begun, a water-supply must be provided sufficient in quantity and of suitable quality. This usually means a pumping equipment, a pipe line and a small storage tank, together with the necessary provision for extension as the work progresses and for making the most probable repairs.

Provision must usually be made for caring for the traffic while the road is being improved. Sometimes the road where the work is in progress can be closed entirely. At other times it is necessary to carry the traffic on the shoulders. This always means a great deal of inconvenience, both to the traffic and to the contractor. Weather conditions are also an important factor, and the layout of the transportation system must be such that rains will cause the least possible delay to the most vital part of the operation, the placing of the concrete.

Use and Value of Progress Charts

A carefully worked-out progress chart or program, showing clearly each of the various operations, from the very inception to the end, is of inestimable value. This chart, as worked out, should show the estimated progress and sequence of each operation which it is hoped to attain day by day throughout the job. During the construction period the actual progress and sequence of the various operations should be plotted each day, so as to show at a glance not only how the work stands, but how it compares with the estimated program, what operations are behind and should be pushed, just when new operations should be begun, and if any operations are conflicting. Such a program in connection with a well-kept system of cost data may readily prove the most valuable item in the entire construction equipment.

One of the chief values of this method is that it serves at once to determine the relative efficiency of different gangs, methods and items of equipment. It also serves as an automatic reminder of when any new operation must be begun and the rate at which it must be pushed. Furthermore, in case of enforced absence of the directing head, even an entirely new man can pick up the threads with the least possible loss or friction. On every job of any magnitude the progress chart should be worked out with the same care as is given to the plans and specifications. The cost data and daily progress after work is begun should be kept with the same scrupulous care as is exercised in keeping the time of the workmen. Satisfactory results cannot be expected, even from the most valuable equipment, unless it is operated in a proper and efficient manner.

ACKNOWLEDGMENT.—Reprinted from *Modern Road Building and Maintenance*, published by Hercules Powder Company, Wilmington, Del.

WHERE CAN I BUY SECOND-HAND CONTRACTING MACHINERY?

Frequently you are confronted with this question in your daily work. A glance at the "Used and Rebuilt Equipment" directory, beginning page 81, may give you the answer.

Automatic Lowering Jacks

THE Duff automatic lowering jack, illustrated herewith, is a particularly useful machine for bridge work. Easy operation is secured by the use of a large number of small teeth on the lifting rack. This jack, made by the Duff Manufacturing Company, Pittsburgh, Pa., is single-acting and of 15 tons capacity. The effort required on the lever is reduced so greatly that strokes can be made very quickly, hence the lift is rapid. Careful attention has been paid to strengthening every part subject to wear and strain and thus insuring a long life. The use of a one-piece steel socket lever does away with the fulcrum pin, side plates and rivets, parts which have caused trouble in the past. The closed-end, grease-packed bushings keep out grit and protect the trunnions against wear by affording constant lubrication. One of the features of the lifting mechanism is the greatly strengthened and simplified mechanism, including a reversing lever which takes the place of the less convenient eccentric; a shield which can be removed without disturbing the working parts; double-pointed pawls, set in true vertical working position, minimizing the side thrust on rack, and offering the greatest insurance against the stripping of teeth, slipping or breakage.

Another feature of these jacks is the transversing base on which any one of the jacks may be mounted. This base permits the moving of the jack horizontally while under load. It has many uses and is mounted on a base of refined malleable iron, the screw being of cold-rolled steel.

AN AUTOMATIC LOWERING JACK OF SIMPLE CONSTRUCTION AND LARGE CAPACITY

Mileage of Public Roads in the United States

THERE are now 2,273,131 miles of public roads in the United States. Of these, 10.9 per cent (a total 247,490 miles) are surfaced roads—roads other and presumably better than mere cuttings in the dirt. Rhode Island leads all the Union in good roads, with a percentage of 58.8 per cent. Massachusetts comes next with 51.7, followed by Indiana, 42.3, Ohio, 33.8, New Jersey, 30.3, and New York, 27.9 per cent. Nebraska is at the foot of the list with a percentage of 0.3, representing 250 miles of surfaced roads out of a total of 80,338. Other backward states are Nevada, 0.5 per cent, Montana, 0.4 per cent, and Kansas, 1 per cent. Ohio has the greatest good road mileage, with 28,312. Nevada has the least, with 65 miles. Texas has the greatest total mileage, with 128,971, and Rhode Island the least, with 2,121.

Road Building to Relieve the Money Stringency

To set a great army of one million men at building highways would release money for local circulation through wages to local labor and in payments to local producers of stone, gravel, sand and other materials. Stimulation in the production of trucks, machinery and raw materials and in engineering and the employment of labor can positively be accomplished with an untrammeled road-building program.

The Control of Explosives

REFORMS in the manner of handling explosives are needed to safeguard life and property. The United States is practically the only civilized government in the world that fails to exercise permanently a national supervision over the manufacture, storage and use of explosives, and under peace-time conditions it is easier to obtain explosives in this country than in any other. Some of the states have no laws of any kind relative to explosives, while in most other states any quantity of explosives may be freely obtained for any purpose.

Large stores of explosives have been found by the U. S. Bureau of Mines within the limits of cities and towns where an explosion might have caused loss of life, limb and property. Powder magazines are in many cases of improper construction, not proof against fire or bullets, and without guard protection.

Not a few accidents to children have been attributable to the careless manner in which powder magazines are locked or secured, and to the abandoning of explosives in quarries and excavations. Occasionally, miners have taken frozen explosives home for the purpose of thawing them, and have blown up themselves and their homes. There have been instances where state convicts used dynamite in their work on the public roads, left it hidden, and, when their terms expired, recovered the explosive and used it for safe-blowing or other criminal purposes. The wholesale destruction of fish by the dynamiting of streams is a common offense. The protection of eminent citizens and of property against bomb outrages is a matter closely connected with proper explosives regulation.

Explosives are fundamental necessities of modern civilization, and their uses in industry are so varied and extensive that their safe disposition and employment is a matter of capital importance to every citizen. For economy and efficiency in use, it is imperative that explosives should be readily accessible. As a result, they are distributed like other general merchandise, and in the absence of regulation and supervision may be obtained easily by anyone. On account of the enormously extended use of explosives during the war, thousands of persons acquired familiarity with their handling and use. With state regulation there could be an accounting for explosives manufactured or used, and means of guaranteeing safe storage.

In the year 1919, in peace-time, there were manufactured in the United States 417,634,470 pounds of explosives. In normal times over 31,000 mines and quarries use explosives. About 55,000 wholesale and retail dealers handle explosives, and over 18,000 concerns engaged in the construction of railroads, highways and waterways use explosives. Altogether, there are over 100,000 concerns using such comparatively large quantities of explosives that special magazines for their storage are an absolute necessity. There are probably more than 500,000 individual consumers of explosives.

During the war 16,000 agents were commissioned by the Bureau of Mines to assist in enforcing war-time regulations. Half a million licenses for the manufacture, sale or use of explosives were issued. There were obtained 90 convictions for violations of the Federal explosives laws. A list of serious explosions in munition and powder plants that occurred during the war is given in Bulletin 198, "Regulation of Explosives in the United States, with especial reference to the administraton of the explosives act of October 6, 1917, by the Bureau of Mines." This bulletin may be obtained by addressing Dr. H. Foster Bain, Acting Director, Bureau of Mines, Washington, D. C.

The Engineer's Obligation

The engineer's obligation to serve is not limited to the duties for which he is paid; he owes it to his equals in service, to his subordinates and to the public at large. His equals are his brothers, with whom he should share his knowledge and experience, should they seek it. His subordinates should find in him the help of good example, the friend with whom they may take counsel, and the mentor who will impart of his knowledge of life, of men, of things, to aid them in shaping their conduct and their purpose.

Building Toronto's New Harbor

THE city of Toronto will soon have one of the finest harbors on the Great Lakes. When the Port Arthur Construction Company, of Toronto, Ontario, Canada, secured a contract for the immense development work in Toronto Harbor, it purchased an Industrial crane which has carried most of the burden. The contract consists of harbor improvement that is, building cribs, dredging, crib filling and concrete work form the main part. The estimated cost runs to about a million and a half dollars. The crane has been making itself useful in many ways. The job has afforded it an excellent chance to display its versatility.

BUILDING THE CRIBS. THE LUMBER IS UNLOADED, PILED, AND SWUNG INTO POSITION BY THE CRANE

During the last year it handled all of the timber for the cribs, a total of 2,150,000 feet. This timber was first unloaded and placed in storage piles, and later the crane carried it to cribs under construction and swung each piece into position. Equipped with a clam-shell bucket, it was used for unloading stone and sand for the concrete work and also large quantities of broken stone for crib filling. In addition, it performs the duties of a switch engine, handling almost every car-load of timber received. This year the crane is handling all the stone and sand for concrete work and approximately 40,000 yards of broken stone for crib-filling purposes.

THE MATERIALS FOR THIS LONG BREAKWATER WERE ALL HANDLED READILY BY CRANE

There are two more Industrial cranes, manufactured by Industrial Works, Bay City, Mich., working on this job. These are owned and operated by the Toronto Harbor Commissioners, who are carrying out some of the projected work themselves. These cranes are also in daily use, lending their services to the speeding-up of this gigantic enterprise.

The engineers of the Port Arthur Construction Company in charge of the work, said that the 15-ton crane had given complete satisfaction and that no time was lost through crane breakdowns, in spite of the fact that this crane was the hardest-worked machine on the job.

Transportation is now in a much disjointed state, looked upon by some as a local, by others as a national, and by others as a world-wide problem. The third group has the correct view. Its ultimate solution depends on the co-ordination of all the agencies, highways, railroads and waterways, as each has its place in the general scheme.—*Professional Engineer.*

A New Gravity Dump Body for Motor Trucks

THE Heil Company, 1243 26th Avenue, Milwaukee, Wis., has recently designed and is now building a gravity-dump body for use on short-wheel-base trucks employed in concrete road building. The body is built in various sizes ranging from ¾ to 1½ yards capacity, and therefore can be used on trucks ranging from ¾-ton to 2-ton. In the latter case dual hoppers would be used instead of making a 2-yard single gravity body. This new body is welded throughout by the electric process, thus eliminating all rivets. The welded construction makes the body absolutely watertight and therefore better adapted for handling wet concrete.

DUMPING POSITION OF NEW, INEXPENSIVE BODY FOR CONCRETE HANDLING

Contractors and engineers have been impressed with the simplicity of this body as regards the operating device. The control which holds the body in place consists of self-locking hooks. The control handle for operating these locking hooks can be reached by the driver without getting out of the cab. The body rolls over on pivots which prevent it from getting out of line. Instead of using control chains, two bars or rods are attached to a cross-member which connects the longitudinal parts of the subframe. Into these are placed coil springs which keep the body firmly in place when in a raised position. They also allow the body when loaded to roll over easily without any perceptible jar whatsoever. Nearly 50 parts have been eliminated from this mechanism, thus greatly simplifying it and reducing its weight.

A Light-Weight Reversible Road Machine

The manufacture of a reversible road machine of 1,400 pounds weight with all the practical features found in two-horse machines, has been achieved by the Austin Western Road Machinery Company, Chicago, Ill. Its Little Western steel grader has a rear axle pivoted at the center to overcome side draft. The frame of the machine can be shifted 27 inches on the rear axle, making it possible to keep the rear wheel against the bank while making first and second cuts.

When the blade is set at an easy cutting angle, it will cut 20 inches outside the wheel. When working at a flatter angle, the distance is increased to 24 inches. The raising racks have a direct lift, the side arms allowing the blade to swing in any position without cramping. All adjustments are within easy reach of the operator, so that one man can drive and operate the machine if so desired. This grader is not intended to do the heavy grading in place of the larger machines, but there is a great deal of road work that it will do just as well at less expense.

What Do Repairs Cost YOU?

A large item of expense attached to many types of streets is, cost of repairs.

Asphalt pavements are economical to maintain.

The pavement illustrated above was built in 1915—the picture was taken in 1921. Notice the excellent condition of the street.

Not one cent has been spent for repairs. That feature is worthy of your consideration.

STANOLIND PAVING ASPHALT, "C"

was used in the construction of this street.

Our booklet "Stanolind Paving Asphalt" containing information regarding this type of road as well as all other asphaltic roads, will be mailed free upon request.

STANDARD OIL COMPANY
(INDIANA)

910 So. Michigan Ave. **Chicago, Ill.**

Pavement illustrated built by Mr. M. H. Lewis, Hoopeston, Ill.

Pageant of Progress Exposition at Chicago's $5,000,000 Municipal Pier, July 30 to August 14

Heavy Paver Shows Speed in Handling Dry Mix

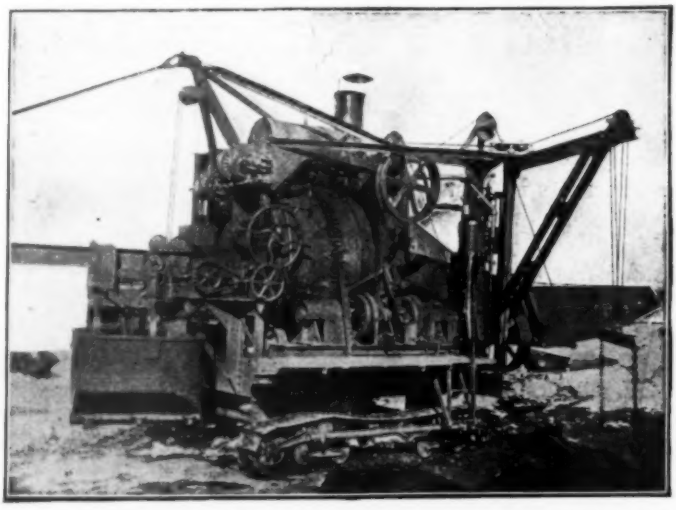
A NEW heavy paving mixer combining unusual speed with positive one-man operation is now being introduced by the Ransome Concrete Machinery Company, Dunellen, N. J. It is claimed by the makers that this machine—the Ransome "21-E"—will discharge dry mix in from 10 to 15 seconds, with an average time of 12 seconds.

As builders and users of paving mixers know, the very dry mixes now specified for paving work are much more difficult than wet concrete to discharge rapidly. The quick discharge of dry mix as handled in the Ransome 21-E paving mixer is, therefore, a feature of special interest to the field.

In comparing the 21-E with the old 14-E, it is interesting to note that the new paver has 10 per cent less parts than has the 14-E. The practical value of these changes, together with an effective grouping of controls, is demonstrated by the ease and speed by which this machine can be handled by a single operator.

The control levers are arranged so that without taking a step the man running the machine can easily and continuously carry on all required operations, such as: lifting batch boxes from an industrial truck; raising the skip; admitting the water; swinging the boom; dumping the mixer; running the bucket out on the boom; dumping the bucket and returning the bucket to the mixer. It is obvious that marked economies in both labor and overhead will be effected by this paver.

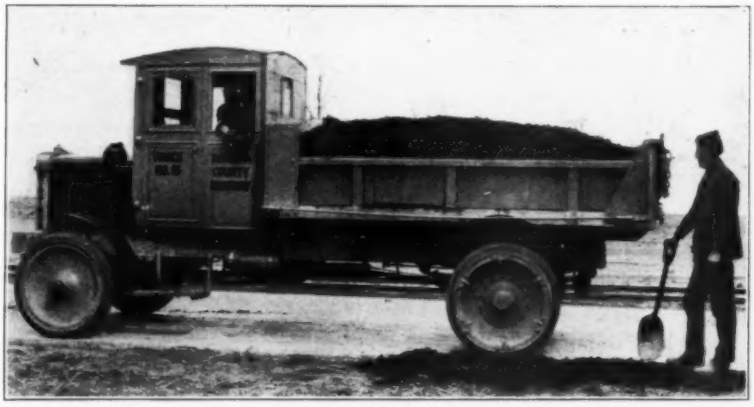
The adoption of crawler traction at first appears a somewhat radical departure. It seems less so, however, when it is understood that the crawler mechanism used is an adaptation of the well-known and thoroughly developed full crawler traction used for "Marion" steam shovels. For heavy machines the full crawler traction is standard practice owing to its ability to traverse unequal surfaces without throwing great strains on the frame. Cast steel crawler links, driving sprockets and gears; front and rear axles of hammered steel; and main frame of 10-inch channels, connected to the cross-struts with gusset plates as well as clip angles, assure ample strength and durability in the carriage. A friction clutch is placed on the countershaft, and each crawler is finished with a separate drive. Reversing gears give forward and reverse motion. There is further provided a separate band brake for each crawler, which assists in making short turns.



SIDE VIEW OF HEAVY PAVER, SHOWING DERRICK, SKIP, MIXER, AND BOOM WITH BUCKET, AS WELL AS CRAWLER TREAD

All operations of the crawler are controlled by a clutch lever, a reversing lever, a steering lever, and 2 foot brakes. The tendency toward simplicity which has so largely influenced the design of the entire machine is shown again in the arrangement of these levers—not only by their convenient grouping, but by providing for the machine to follow the direction in which the operating levers are moved.

The supporting frame of the paver proper is of rigid construction and able to withstand the strain of swinging the boom, with its loaded



Winther Trucks Maintain County Roads

The excellence of Kenosha County highways is due, in large measure, to Winther hauling service.

Summer and winter, you can see this 3½-ton Winther pulling heavy loads of gravel from the pit, distributing cement, sand, and ashes, or transporting "fill-in material to outlying points of the county.

There is a size and type of Winther for every trucking need. Write us to-day for literature and prices.

Dependability is the keynote of its service.

"But in spite of this strenuous hauling" says Commissioner Herzog, "our Winther has cost us practically nothing. $14.44 represents its total repair bills for the past year. Fuel and lubricating expenses have been in the same moderate proportion."

Such consistency and economy in operation is characteristic of Winther trucks. It enables contractors to handle their work surely and profitably.

Write us about your hauling requirements; let us tell you which capacity and type of Winther truck is best suited to your needs.

Winther Motor Truck Company

Manufacturers of Motor Trucks and Motor Cars

Kenosha, Wis.

WINTHER TRUCKS

bucket at right angles without deflection.

The drum roller shafts are of cold-rolled steel fitted with rollers of car wheel metal 16 inches in diameter and mounted on Hyatt roller bearings. The drum is of all steel plate construction, making it lighter and stronger than with cast steel drums. The drum roller tracks are forged and rolled from billets of locomotive tire steel.

The machine is so constructed that the operator can at all times see into the drum. This is a feature deserving of greater attention than it sometimes gets. Every operating part of the machine is easily accessible, and there are no parts revolving when not in use.

Low bridges are no barrier to the Ransome 21-E, as the super-frame is so hinged to the supporting frame that the former can be easily swung down out of the way. The smoke-stack and the two brackets carrying the top sheave wheels are also hinged so that they can be swung down. "Knocked down," ready for travel or shipment, it is but 11 feet in height, and 2 men and a wrench can dismantle or erect it in 30 minutes.

The loading derrick is designed to be placed on either side of the machine, and can be easily shifted from one side to the other. Its height will permit the lifting of a batch box directly from a motor truck. A ratchet is provided for holding the load at any point.

The power loader bucket is of the open-end type, wide enough at the bottom to permit motor trucks to dump direct, or for two wheelers to dump at a time. When fully raised, the bucket has a 48-degree slope, insuring quick, clean discharge.

The winding cones are properly shaped to take full advantage of the difference in pull, and are grooved to insure true winding of the ropes. Provision for keeping the ropes in place is taken care of by designing the power wheels with deep sides. The wheel is also large enough in diameter to give ample purchase. The power loader hoist is equipped with a friction clutch, automatically released when the bucket reaches its maximum height, at which point the clutch brake automatically sets, holding the skip in discharge position.

The water-tank is of standard Ransome construction. Direct-acting gate valves control the water-supply both in and out of the drum. Any leakage from the air valve is carried to the side of the mixer and thus cannot spatter on the drum.

A steel drawer beneath the operator's platform forms a roomy and convenient tool box. Over the platform is provided a canvas shelter for the comfort of the operator.

This paver can be equipped with either steam power, gasoline or electric motor drive. Where steam power is desired, the power is equipped with a 14-horse-power engine, fully enclosed, with counterbalanced crank-shaft, and a 16-horse-power boiler built to A. S. M. E. specifications. The exhaust is piped into the base of the stack to increase the draft. A blower is also provided for raising steam before the mixer gets into operation. With gasoline drive a heavy-duty tractor-type engine rated at 25 horse-power at 900 r.p.m. is used. For electric drive a 20-horse-power electric motor may be used, either A. C. or D. C.

The first work on this machine was put on the drafting board early in October, 1919. The original designs were perfected during the winter of 1919-1920, and the first 21-E was completed in the spring of 1920. This first machine was put on a job near the Ransome plant and watched daily by the company's engineers and mechanics. At the end of the season the paver was purchased by the man on whose job the machine was being run.

The National Standard Truck Cost System

The illustration below shows a portion of form 2 of the National Standard Truck Cost System and gives the monthly analysis of operation of a 3- to 3½-ton capacity Packard truck. The CONTRACTORS' AND ENGINEERS' MONTHLY fully believes in the value of this system for determining accurately the cost of operation of contractors' trucks. The system was devised by automotive engineers in a series of conferences extending over a long period of time, and represents much thought on the subject. Subscribers to the CONTRACTORS' AND ENGINEERS' MONTHLY, who are not acquainted with this system may secure free copies on application, as we still have a few left for our regular readers. It will be a case of first come, first served.

Form 2. NATIONAL STANDARD TRUCK COST SYSTEM. TRUCK OWNERS CONVENTION, INC., Cincinnati, O.

MONTHLY ANALYSIS OF OPERATION 3-3½ CAPACITY

	Name of Truck Owner or Fleet Title (If Fleet Column #1)	June	July	Aug
A.	Number of days operated	24	26	27
B.	Number of round trips	48	63	65
C.	Delivery or pick up stops	102	106	122
D	Total units Tons ... out	166.5	169.7	219
E.	Total units Tons ... in	64.5	88.2	118.5
F.	Miles traveled	1082	1184	1176
G.	Gallons of gasoline or K. W. H. current	213.5	226.5	2.1
H.	Pints of cylinder oil	14	10.7	87
I.	Hours available but not used	10	-	-
J.	Hours loading	130.5	139.8	165.6
K.	Hours running including stops	126.5	145.7	141.9
L.	Hours laid up for repairs			
M.	Hours with helper			
N.	Trailer data			
	AVERAGES FROM ABOVE			
B1	Round trips per day	2.	2.44	2.41
C1	Delivery or pick up stops per day	4.25	4.08	4.52
D1	Total units Tons per day	10.46	9.92	10.30
E1	Average units Tons ... per trip	.533	4.8	5.04
E2	Unit Tons ... miles per day	117.38	118.7	118.2
F1	Miles traveled per day	45.08	45.54	43.55
F2	Average round trip distance	22.54	22.35	18.07
G1	Miles per gal. of gasoline or per K. W. H.	5.0	5.23	4.88
H1	Miles per gallon of cylinder oil	61.	110.65	10.8
J1	Average hours loading per day	5.44	5.38	6.13
J2	Average minutes loading per trip	163.2	153.2	152.
K1	Average hours running including stops per day	5.27	5.60	5.2
K2	Average hours in service per day	10.6	10.9	11.3
P.	Average speed in miles per hour	8.5	8.1	8.2
Q.	Estimated running time per mile			
R.	Estimated time per customers stop (to nearest minute)			
S.	Cost per day operated	19.73	19.33	19.11
T.	Cost per mile	.43	.44	.44
U.	Cost per unit Tons	1.81	1.95	1.86
V.	Cost per unit mile	.167	.429	.423

USE HELTZEL STEEL FORMS ON YOUR ROAD JOBS

STEEL FORMS For All Concrete Work

"SIMPLY MADE SIMPLY LAID"

HELTZEL steel forms should be used on all your road jobs because they are so easily set up and taken apart. They are strong as only steel can be and stand up admirably under the finishing machine. Heltzel steel forms enable you to build roads, sidewalks and gutters in record time. They last several seasons and have proven their superiority over all other forms. Hundreds of contractors are using Heltzel steel forms with unbounded satisfaction and a big saving in time and money and labor. Send us your name for illustrated material—no obligation.

The Heltzel Steel Form & Iron Co., Warren, O.
BRANCH OFFICES IN PRINCIPAL CITIES

Repair Your Streets with
THE LUTZ SURFACE HEATER

It softens asphalt and other bituminous pavements. It vulcanizes the old and new material into a perfect bond. It cements Asphalt on Granite, Brick, Cobble, or other hard pavements. It makes re-surfacing and maintenance easy and inexpensive.

Illustrated Particulars on Request

Equitable Asphalt Maintenance Co.
1901 Campbell St. Kansas City, Mo.

Repairing an Asphalt Pavement, New York

Where Quality Counts You Will Always Find The Famous

ACME ROAD BUILDING MACHINERY

LINE FOR EVERY PURPOSE

SEND FOR OUR DESCRIPTIVE MATTER

ACME ROAD MACHINERY COMPANY, FRANKFORT, N. Y.

IDEAL EXPANSION JOINT

The Ideal Method of Providing for Expansion in Improved Pavements

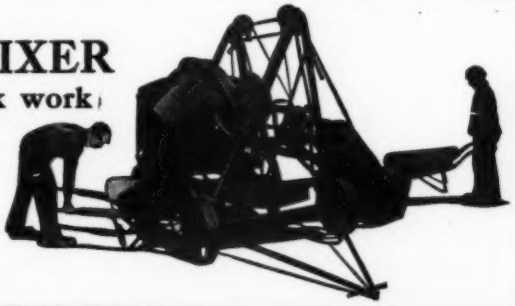
THE WARING-UNDERWOOD CO. FERNWOOD, PA.

JAEGER CONCRETE MIXER

for paving and sidewalk work

Used by progressive municipalities and contractors.
Is your town progressive?
WRITE FOR DATA

The Jaeger Machine Co.
215 Dublin Avenue
COLUMBUS : : : OHIO



RELIANCE ROAD BUILDING AND QUARRY EQUIPMENT.

CRUSHERS
ELEVATORS
SCREENS
BINS
MOTOR TRUCKS
SWEEPERS
SCARIFIERS
OILERS
CAR UNLOADERS
MOTOR FLUSHERS

Prompt Shipments.

Write for Catalogue and Prices.

UNIVERSAL ROAD MCHY. CO.
KINGSTON, N. Y.
Boston Office, 141 Milk Street.

Tarvia
Preserves Roads Prevents Dust

THE Tarvia Service Department offers a mighty helpful service to road engineers, contractors and city authorities. It is manned by highway engineers of long experience, and provided with special apparatus of various kinds for handling Tarvia to the best possible advantage.

In many sections of the country we can provide automobile-tank service that brings the Tarvia hot from the works or from the tank-cars and delivers it on the job promptly and economically.

If you want real co-operation and service in your road work, call on the Tarvia Department of our nearest office.

The Barrett Company

New York, Boston, Cincinnati, New Orleans, Minneapolis, Chicago, St. Louis, Pittsburgh, Dallas, Philadelphia, Cleveland, Detroit, Kansas City, Salt Lake City

DU PONT

EXPLOSIVES

For All Industrial Uses

Red Cross Extra, Gelatin and Straight Dynamites, Du Pont Extra Gelatin and Straight Dynamites, Repauna Gelatin, Du Pont Blasting Gelatin, Du Pont R. R. P., Permissible Explosives, Blasting Powders.

Send for descriptive booklets and price lists.

E. I. du Pont de Nemours & Co., Inc.
Sales Department, Explosives Division
WILMINGTON, DELAWARE

DOW Calcium Chloride Flake
Preserves Gravel & Macadam Roads

The Michigan State Highway Department, after thorough research on binders and dust preventives for gravel and macadam, have used and are using thousands of tons of Calcium Chloride on graveled trunk roads.

Dow Calcium Chloride Flake is made on the same precise accurate basis as are the vast quantities of other chemicals produced in the Dow plant which covers more than one hundred thirty-five acres of ground and employs more than one hundred graduate chemists and internationally famous research men.

If you would make a reputation for low cost road maintenance and longer lasting roads, let us discuss with you by letter at once, the value of Dow Calcium Chloride Flake for your particular road problems, whether on trunk roads or in parks, cemeteries and private estates where dust prevention is a problem.

The Dow Chemical Company
Midland, Mich. U. S. A.

USED AND REBUILT

EQUIPMENT

AT ATTRACTIVE PRICES

FOR RENT
OR
FOR SALE

Locomotive Boilers
Air Compressors
Hoisting Engines
Steam Pile Hammers
Centrifugal Pumps
Nye Pumps
Pulsometers
Diving Gear
Buckets
Cableway Outfits

MARVIN BRIGGS, INC.
169 Sixth Street
BROOKLYN, NEW YORK

LOCOMOTIVE CRANES

1—25-ton Industrial Locomotive Crane, 8-wheels, standard gauge. MCB., double drum for handling clamshell bucket. Equipped with 50-ft. steel lattice boom. ASME boiler. Crane new in 1918. Excellent condition.

1—7½-ton Osgood Locomotive Crane, 4-wheel, standard gauge. Complete with 40-ft. booms. ASME, butt strapped boilers. Double drum for clamshell operation. Splendid condition.

BYERS AUTO CRANE

1—No. 3 Byers Crane. Caterpillar traction. New August, 1920. Equipped with 30-ft. boom and ¾-yd. Owen clamshell bucket. Condition equivalent to new. Located Youngstown, Ohio.

STANDARD GAUGE LOCOMOTIVE

1—13 x 18 American, standard gauge Saddle Tank. Built new Dec., 1913. Type O-4-O. MCB and ICC. 165 lb. steam. Full extended tank. Westinghouse Air Pump and straight line air. Overhauled and equipped with set of new tires.

CABLEWAY DRAGLINES

1—10 x 12 Lidgerwood Cableway Dragline. Engine 10 x 12. Outfit complete with ASME boiler, 70-ft. tower, 1½-yd. dragline bucket. Cable for 600-ft. span. New 1918. Splendid condition.

1—1½-yd. Sauerman Dragline. 100-ft. steel tower, 900-ft. span, 100-H. P. motor. 60 cycle, 3 phase, 440 volts.

UPRIGHT BOILER

1—60-H. P. ASME Upright Boiler. Complete with all fittings and fixtures. Brand NEW. Built by Coatesville Boiler Works. Located in Philadelphia.

STEAM SHOVELS, DUMP CARS, DERRICKS.

B. M. WEISS
1324 Widener Bldg. Philadelphia, Pa.

AT YOUR SERVICE

CONSTRUCTION EQUIPMENT

Whatever equipment you need let us quote you on it. We handle only new and slightly used equipment of the most recent models. You do not sacrifice quality when you buy from us, but our offerings are from **25 to 40 per cent below the manufacturers' price.**

AN UNUSUAL OFFERING

One 20-ton **Browning Locomotive Crane,** standard gauge, eight wheel, built Oct., 1919, A. S. M. E. boiler, fifty-foot boom, double drums, M. C. B. trucks, outriggers. This crane is in excellent condition. The price we have placed upon it makes the offering unusual and one not to be overlooked.

GREY STEEL PRODUCTS COMPANY
111 Broadway, New York City **Phone Rector 8542**

LOCOMOTIVE CRANES

1—20 Ton Browning Locomotive Crane, 8-Wheel, MCB., 50 Ft. Boom.
1—20 Ton Industrial Locomotive Crane, 8-Wheel, MCB., 50 Ft. and ¾ Yd. Bucket.
1—15 Ton 4 Wheel Locomotive Crane, 38' Boom with or without Bucket.

BYERS AUTO CRANES

3—Buyers Auto Cranes—Steam, Kerosene and electrically operated, with or without Buckets.

CONCRETE MIXERS

1—10 E Koehring on traction wheels, steam operated, with boom and bucket.
2—1 Yd. Multi-Foote Mixers on Caterpillar traction, Paver types.

CARS

20—Koppel 24" gauge cars 1½ Yd.
18—2 Yd. 30" gauge cars.

HOISTING ENGINES

3—7x10 Hoisting Engines D.D. D.C. with Boilers.
1—8x10 Hoisting Engine with Boiler and Boom Swinger.
1—8 x 10 DC Double Drum Skeleton.
1—10 x 12 DC Triple Drum Skeleton.

DERRICKS, CLAM-SHELL BUCKETS, COMPRESSORS.

FORSYTHE BROTHERS
Hudson Terminal Building
NEW YORK CITY

A GOOD EXAMPLE TO FOLLOW

It will only cost two cents and it may save you quite a little more to let me know what equipment you need. If you are interested in a

LOCOMOTIVE CRANE,

I own a twenty-ton Ohio, Model "D" equipped for handling a clam shell bucket and it's ready for work today. Just drop me a line, I am in business to serve you.

PHILIP T. KING
Hudson Terminal Building NEW YORK
Phone, Cortlandt 2958

CRAVEN
Equipment—Specials

SEND FOR LIST TO-DAY

FRANK T. CRAVEN COMPANY
Hudson Terminal
46 CHURCH STREET NEW YORK
Telephone, 6341-7664 Cortlandt

Attention of Road Contractors

For Sale or Rent

30 F. W. D. Motor Trucks, Four Wheel Drive Equipped with 3 yd. Steel Dump bodies, Wood Hoists adapted for Road or Excavating Contractors. Price $2,500.

J. P. WHITE CO.
Passaic, N. J.

TANKS FOR SALE
In all parts of the country

Over 4000 steel storage tanks
Over 2000 wood tanks
Over 500 tanks with agitators, jackets, etc.
Over 1800 rectangular steel tanks
Over 1500 glass enameled tanks
Over 1250 steel pressure tanks
Over 15 tanks and towers

NEW AND USED TANKS
CHEMICAL EQUIPMENT
MECHANICAL EQUIPMENT

Largest exclusive dealers in tanks

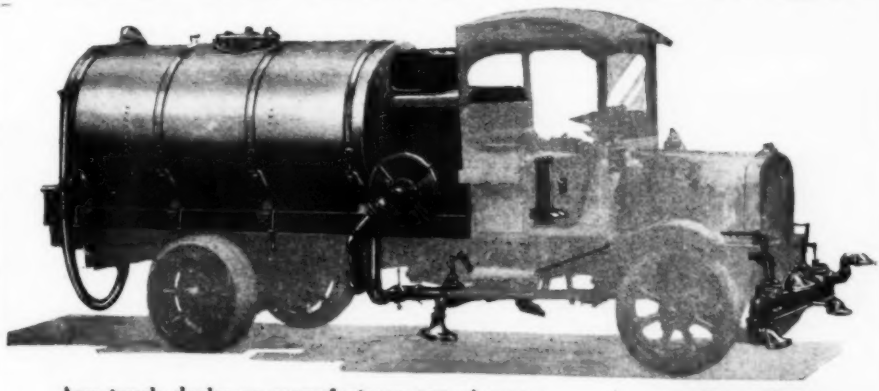
THE CURTISS-WILLIS CO.
30 Church St., N. Y.

PIPE

Good second hand pipe in No. 1 condition with good collars and threads in all sizes from ¾" to 14" suitable for steam, or water purposes, culverts, or piling. Send us your inquiries and let us quote you prices.

MAX ZEIGLER & BROS.
MUNCIE, INDIANA

"STUDEBAKER MODEL" FLUSHING UNIT WITH SPRINKLING ATTACHMENT



Any truck dealer or manufacturer can give you information on a complete outfit.

We will send catalog and data to all interested.

MUNICIPAL SUPPLY COMPANY
STREET FLUSHING AND SPRINKLING EQUIPMENT
SOUTH BEND, INDIANA

STREETS KEPT CLEAN

TAKING THE UNCERTAINTY OUT OF HAULING

How often you see trucks stalled on the highways around every large city—one of the penalties of buying an assembled truck with parts of uneven and doubtful quality!

More and more, as hauling distances increase, the thinking truck buyer is turning to the Packard—a truck of unified design and construction—a truck every part of which has to pass the close scrutiny of men who are authorities in automotive engineering.

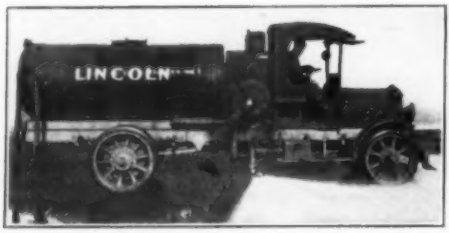
"Ask the man who owns one"

PACKARD MOTOR CAR CO., Detroit

White Trucks

do the most work for the least money

THE WHITE COMPANY
CLEVELAND



Another **FEDERAL**

"SATISFACTORY IN EVERY PARTICULAR"

The City Engineer of Lincoln, Nebraska, says:

"We have been using this Federal 5-ton Truck on the streets of Lincoln for the past year and have found it more than satisfactory in every particular. It is equipped with a 1200 gallon flusher tank, and it handles it under all conditions with perfect satisfaction. We have pretty nearly all kinds of trucks in service in the city departments, and in my opinion the Federal truck is far superior to any truck that we now have in service."

FEDERAL MOTOR TRUCK COMPANY
34 FEDERAL ST. DETROIT, MICH.

"CATERPILLAR" TRACTORS REG. U.S. PAT. OFF. **and**

LAND LEVELERS

An ideal combination outfit for contractors and road commissioners. The 5-Ton and 10-Ton "Caterpillar" Tractors, built to military standards, are everywhere acknowledged supreme in roadmaking, hauling and general contracting service.

Catalog sent upon request.

There is but one "Caterpillar"—Holt builds it.

The HOLT Manufacturing Company, Inc.
Peoria, Illinois
Factories at Peoria, Ill., and Stockton, Calif.

TIFFIN

Municipal Vehicles

Reliable and Economical

Motor Trucks, Power Street Flushers, Garbage Wagons and Trucks, Sanitary Carts, Dump Wagons, etc.

The TIFFIN WAGON COMPANY, Tiffin, Ohio

HOLLOW TILE

The Most Economical Form of Permanent Construction

Made in large units, Hollow Tile is quickly and easily laid at a low labor cost. This, and its freedom from shrinking, cracking or other deterioration, make Hollow Tile an exceptionally economical form of permanent construction.

"By frost, nor fire, nor flood—nor even time, is well burned clay destroyed"

Standard Building Code Technical Books
Hollow Tile Hand Book — Hollow Tile Manual

General Books
Hollow Tile for the Home — Hollow Tile for the Farm

The Hollow Building Tile Association
Representing America's Leading Manufacturers
Conway Building, Chicago

Made in ten sizes

PORTABLE TOOL HOUSES

Sectional All Steel Construction

HANDY TO HAVE — EASY TO SHIP
QUICKLY ERECTED

CAN ALSO BE USED AS

A STORAGE MAGAZINE FOR EXPLOSIVES

SEND FOR DESCRIPTIVE BOOKLET

LITTLEFORD BROS.

500 E. Pearl Street — Cincinnati, Ohio

Kelly-Springfield

Caterpillar Tires

Kelly-Springfield Tire Co. **New York, N. Y.**

CONCRETE CONSTRUCTION HANDBOOK

96 pages, illustrated, and special Service Sheets or Bulletins on 50 Special Subjects, free to inquirers living east of the Mississippi.

Alpha Portland Cement Co.

General Offices: **EASTON, PA.**

Branch Offices: **New York, Boston, Phila., Baltimore, Savannah.**

Plants: **Martins Creek, Pa., Cementon, N. Y., Jamesville, N. Y., Manheim, W. Va.**

WARRENITE BITULITHIC

MEANS UP-TO-DATE

Road and Street Construction

Write for illustrated booklet

WARREN BROTHERS COMPANY

Executive Offices: Boston, Mass.

DISTRICT OFFICES:

New York, N. Y.	Utica, N. Y.	Toronto, Ont.
St. Louis, Mo.	Winnipeg, Man.	Phoenix, Ariz.
San Francisco, Cal.	Nashville, Tenn.	Vancouver, B. C.
Chicago, Ill.	Portland, Ore.	Minneapolis, Minn.
Richmond, Va.	Los Angeles, Cal.	

Road-Building by Tractor Quicker and Cheaper

IN breaking new roads, in grading, scarifying, plowing, excavating, leveling, and in heavy hauling, the Best Tracklayer Sixty does the work better and faster than horses and does it at less cost.

Its tremendous drawbar pull enables the Best to maintain an even cut with the grader. The power is unfaltering. There are no animals to favor on tough soil. No expert drivers needed to keep horses pulling together. The Best furnishes compact, dependable, easily-managed, flexible power, taking the place of 30 horses or mules and operating at a much lower cost. Besides, the Best will do a great deal of work which horses cannot perform.

Another advantage in favor of the Best Sixty for road work is its ability to negotiate ground too soft for animals and too rough for trucks. The long, wide tracks distribute the weight over so great an area that the ground pressure per square inch is less than that of the average-sized man. The tracks also bridge ruts and holes and gaps, enabling the Best to work efficiently under very unfavorable ground conditions.

There are many mechanical features of the Best that are responsible for Best performance. This tractor is the result of a development covering many years of tractor-building experience. Design, choice of materials, engine, workmanship—all have been time-tested and proven in actual practice. For years the Best has been conspicuously successful on the big heavy-duty work of the West.

Our catalog fully explains these mechanical features and their time-tested advantages. Write for it. Also ask for the name of our nearest dealer.

C. L. BEST TRACTOR CO.

SAN LEANDRO CALIFORNIA

PERFORMANCE COUNTS

Mack TRUCKS

The record of MACK equipment in all classes of municipal work is yours for the asking.

Motorize your equipment and save labor.

INTERNATIONAL MOTOR CO.

Public Works Department

NEW YORK

LYNCHBURG FOUNDRY COMPANY
LYNCHBURG, VA.
Manufacturers of
Cast Iron Water and Gas Pipe
Flanged Pipe and Flanged Fittings
QUICK—RELIABLE SERVICE

MECHANICAL RAPID SAND FILTRATION PLANTS
FOR
WATER WORK SYSTEMS
ALSO
"HOLYOKE" FIRE HYDRANTS
"STREETERS" REMOVABLE PLUGS
NORWOOD ENGINEERING CO.
Florence, Mass.

BUSCH-SULZER BROS.-DIESEL ENGINE CO.
Main Office and Works
ST. LOUIS, MO.
Sales Offices
60 BROADWAY NEW YORK
RIALTO BLDG. SAN FRANCISCO

CHEMICALS
for Water Purification
We manufacture the highest grades of
SULPHATE of ALUMINA
also
CHLORIDE of LIME
and
LIQUID CHLORINE
PENNSYLVANIA SALT Mfg. Co.
WIDENER BLDG. PHILADELPHIA, PA.

DU PONT
Concentrated Filter
ALUM

OUR 22% Al_2O_3, containing 73% aluminum sulphate, is the highest strength alum on the market today and for this reason the most economical.

It is especially adapted for use where low alkalinity and high turbidity make filtering problems difficult.

It removes all vegetable matter and diminishes the amount of bacteria in the water.

We also manufacture 17% alum which can be used in any type of mechanical filter plant.

E. I. du Pont de Nemours & Co., Inc.
Sales Dept.: Acids & Heavy Chemicals Division
WILMINGTON, DELAWARE
Branch Offices:
NEWARK, 240 Vanderpool Street, Telephone, Waverly 4670
PHILADELPHIA, 3500 Grays Ferry Road, Telephone, Dickinson 50

Iron Horse Metalware for Contractors'

Galvanized Cans	Engineers' Cans
Pails	Oily Waste Cans
Rubbish Cans	Ash Cans
Garbage Cans	Corrugated Baskets

SEND FOR OUR CATALOGUE

ROCHESTER CAN CO.
109 Hague St. Rochester, N. Y.

CLEAN YOUR WATER MAINS

One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal —and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

Hudson Terminal Building

NEW YORK CITY

Illustrated book—free

The eye-opening story of wood pipe—its life, uses and economy—is interestingly told in the finest pipe book ever printed. The data file of NO engineer or Contractor who in any way recommends, or influences decisions for pipe, is complete without a copy. Request yours today. * * * WESTERN WOOD PIPE PUBLICITY BUREAU, White Bldg., Seattle, Wash.—Monadnock Bldg., San Francisco, Calif.

Redwood *Douglas Fir*

WOOD PIPE

CONTINUOUS STAVE-WIRE WOUND-BORED

SEWAGE DISPOSAL

Siphons
Imhoff Tanks
Ejectors
Water Regulators
Screens
Joint Compounds

PACIFIC FLUSH-TANK CO.

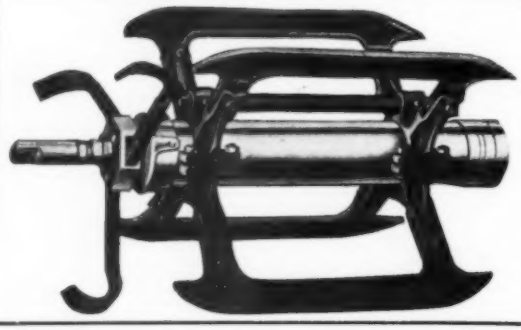
Singer Bldg., New York
4241 E. Ravenswood Ave., Chicago

LOCK BAR STEEL PIPE

MAXIMUM { STRENGTH
CARRYINC CAPACITY
DURABILITY

SIZES 20" TO 72" DIA.

EAST JERSEY PIPE COMPANY
7 Dey Street New York City



Clean Your Sewers with the

TURBINE MACHINE

It makes no difference what may clog your sewers, this machine will do the work and do it satisfactorily.

Send for our latest catalog.

Turbine Sewer Machine Co.
195 Eleventh Street
MILWAUKEE :: WISC.

Industrial Piping Equipments

GRINNELL COMPANY through 70 years of experience has gained a fund of practical knowledge of industrial piping that is a distinct asset to those seeking an unusual service in industrial piping work. Our experience covers:

Automatic Sprinkler Systems—Steam, Hot Water and Gas Heating—Power and Related Piping—Pipe Bending—Threading and Fabricating—Fittings, Pipe, Valves—Welding—Process Piping of all kinds—Compressed Air Lines—Water Supply Systems—Constant Level Size Circulating Systems—Piping for Acids and Alkalies—Hydraulic Piping—Gordon Dryers—Safety Fuel Saver.

GRINNELL COMPANY

Executive Offices Providence, R. I.

Offices in all large cities in the United States and Canada

Otterson Auto-Eductor CLEANS CATCH BASINS

SAVES TIME—MONEY—LABOR

The Otterson Auto-Eductors are saving thousands of dollars yearly to users. Efficient, economical and sanitary in operation, clean catch basins in from four to twenty minutes.

Equipment mounted on any 5-ton chassis of suitable standard make.

The Otterson Auto-Eductor Co.
817 Fairbanks Bldg., Springfield, Ohio

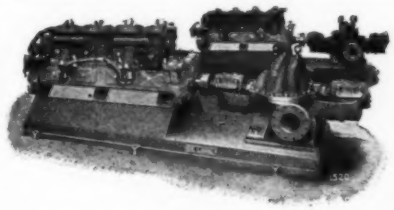
FAIRBANKS-MORSE

Portable Wood Worker

With attachments for molding, mortising, rabbeting jointing, matching, boring, sand papering, tool grinding, sawing irregular shapes and tongue and groove work.

Equipped with a "Z" Engine

CONTRACTORS' EQUIPMENT DEPT.
FAIRBANKS, MORSE & CO.
30 CHURCH ST. - NEW YORK CITY
BALTIMORE OFFICE 115 East Lombard St.
BOSTON OFFICE 245 State Street
PHILADELPHIA - - 917 Arch Street



Pumping *without* Steam

The accompanying photograph shows two De Laval six-inch two-stage centrifugal pumps, driven by an 8-cylinder gasoline engine. Each unit has a capacity of 960 gal. per min. against 349 ft. head at 1400 r.p.m. This combination offers the maximum of simplicity and reliability where water is wanted in large quantities and steam or electric power is not available. Units of this type are built for direct connection to engines using gasoline, natural and artificial gas and oil. The gearing, plungers, packings, and valves of reciprocating pumps are eliminated and the absence of heavy friction at starting is a great advantage where internal combustion engines must be started by hand.

If you are interested in centrifugal pumps for any situation, write for our new Centrifugal Pump Catalog B-96.

De Laval
Steam Turbine Co.
Trenton, N. J. 173

VALUABLE INFORMATION YOU SHOULD HAVE !

FREE ON REQUEST.

And They Are Still Buying "Americans"—

Back in 1915, the City of Hastings, Nebraska, after having carefully investigated deep well turbines—purchased an "American" Deep Well Turbine.

In 1919, a greater supply of water was necessary—and they purchased another "American" Deep Well Turbine!

Again in 1920, when more pumps were needed—they purchased an "American" Deep Well Turbine!!

It has taken nearly half a century of experience and design to develop pumping machinery that gives the sort of service that inspires repeat orders—"American" service is **consistently good.**

The American Well Works
General Offices and Works, Aurora, Ill.

NORDBERG MACHINERY

We make a complete line of

STEAM ENGINES
OIL ENGINES
MINE HOISTS
AIR COMPRESSORS
BLOWING ENGINES
CONDENSERS

Our experienced engineers will gladly consult with you

Nordberg Manufacturing Co.
Milwaukee, Wisc.

CRANE

VALVES—FITTINGS
STEAM SPECIALTIES

are made in all sizes for all pressures and air purposes.

CRANE CO.
836 S. MICHIGAN AVE. CHICAGO

EVERYTHING FOR THE WATERWORKS

Tapping Machines, Hydrants, Valves, Gate Valves, Fire Hydrants, Water Works Specialties. Write for booklet.

A. P. SMITH MFG. COMPANY
EAST ORANGE, NEW JERSEY

DES MOINES TANKS

PLATE WORK
Structural Steel

We design, fabricate, and also erect in any part of the world, structural steel and plate work of every description.

Write for catalogue on the subject in which you are interested.

Pittsburgh-Des Moines Steel Co.
836 Curry Building, Pittsburgh, Pa.

Des Moines, 936 Tuttle Street; New York, 13036 Hudson Terminal; Chicago, 1236 1st Nat'l Bank Bldg.; Washington, 936 Munsey Bldg.; San Francisco, 336 Rialto Bldg.; Dallas, 1236 Praetorian Bldg.; Detroit, 1136 Book Bldg.; Canadian Des Moines Steel Co., Ltd., 236 Inshes Ave., Chatham, Ont.

-DES MOINES-

MUELLER

WATER MAIN TAPPING MACHINES

and all kinds of Water Works, Gas Works and Plumbing Brass Goods.

Strictly High Grade Products which give the utmost in service at the smallest upkeep expense.

Fully Warranted

H. MUELLER MFG. CO.
DECATUR, ILL.
New York San Francisco

Distant Control of Gate Valves
BY THE
Dean Control System

Easily Applied to Your Existing Valves
Any Pressure Size or Location
Electrically Operated From Any Circuit
Operation is Positive
Shutoff Effected in Few Minutes

WATERPROOF—For Vault Installation.

CONTROL—From any Number of Distant or Local Points.

PAYNE DEAN LIMITED
103 Park Ave., New York
Made by Cutler-Hammer

UNIVERSAL CAST IRON PIPE

16-INCH LINE ON ALLEGHENY AVENUE

In Philadelphia's high pressure fire system there are 36 miles of UNIVERSAL PIPE

HAVE YOU PARTICULARS?

THE CENTRAL FOUNDRY COMPANY
90 WEST STREET, NEW YORK, N. Y.

SALES OFFICES: New York, Chicago, Atlanta, Dallas, San Francisco

U-362

APPROVAL

HERSEY DETECTOR METER

The Hersey Detector Meter has been accepted for thirteen years in 3, 4, 6, 8, 10 and 12 sizes without any restrictions or conditions of any kind by every Insurance Company Stock and Mutual doing business in the United States, and by the Water Departments and Water Companies in more than 600 Cities and Towns for use on over 4,000 Fire Services protecting over $2,000,000,000 worth of Insured Property

HERSEY MANUFACTURING COMPANY

BOSTON NEW YORK CHICAGO COLUMBUS, O

PHILADELPHIA ATLANTA SAN FRANCISCO

Do You Sell Sixty or Eighty Per Cent of Your Pumpage?

The average waterworks does not realize in money returns more than 60% of the water sent from the source of supply—80% or even more is attainable.

The Simplex Pitot Recorder

will enable you to discover and locate the loss and leakages responsible for this discrepancy.

Our expert engineers with their instruments and methods are available either to conduct water waste surveys or to give the necessary instructions to your own men, all of which has been done in many cases with most gratifying results.

SEND FOR BULLETIN

In writing refer to this publication

SIMPLEX VALVE AND METER CO.

5722 Race Street, Philadelphia

NORTHERN ROTARY PUMPS

¶ Will deliver more gallons per minute per horsepower than any other pump.

¶ There are over three hundred Users of Northern Rotary Pumps who will testify to this fact.

¶ The Northern Rotary Pump can be furnished to fit any truck for fire service—on hand drawn trucks as electrically or gasoline driven units—as stationary units with electric or gasoline motors for fire or water works service.

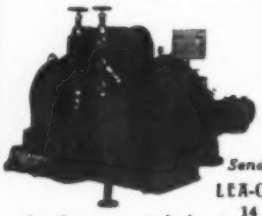
Write for our new catalog today.

NORTHERN FIRE APPARATUS CO.

MINNEAPOLIS, MINNESOTA

Manufacturers of the Northern Trailer Pump for Fire Service

LEA-COURTENAY PUMPS



Lea-Courtenay standard Underwriters' Fire Pump

Centrifugal pumping machinery for every pumping service

Send for Bulletin H-4

LEA-COURTENAY CO.

14 Maine Street

Newark, N. J.

PITTSBURGH RECORDING METERS

Direct reading seven-day charts

The Meter You Were Waiting For

PITTSBURGH FILTER & ENGINEERING CO.

PITTSBURGH, PA.

Works, Oil City, Pa.

Sales Office, Kansas City, Mo.

Does Your Stock of Pipe-Fittings Include Ford "RAMS-HORN" Meter Frames?

There's a reason why so many meter men swear by "Rams-horns"! They are so down-right handy when it comes to installing, replacing or removing meters that ordinary fittings are out of date!!

Just drop us a card, please

Ford Meter Box Company

Everything But The Meter

Wabash, Indiana

Also Manufacturers of Meter Boxes, Meter Testing Machines, Adjustable Pipe Couplings

PUT YOUR PUMPING PROBLEMS UP TO PUMPING EXPERTS

Indiana "ECONOMY"

AIR LIFT SYSTEMS FOR WELLS, Air Lift Separator-Pumps, Air Compressors, Air Receivers, Electric Motors, Centrifugal Pumps, Reciprocating Pumps, Deep Well Pumps, Impeller Pumps, Gasoline and Oil Engines, Indiana Engineering Service.

ASK FOR OUR

"Booklet on Deep Well Pumping"

INDIANA AIR PUMP COMPANY

INDIANAPOLIS, INDIANA

Interchangeability *is a feature of the* TRIDENT (Enclosed) Gear Train

Patents Applied for

IT IS INTERCHANGEABLE

The Trident (Enclosed) Gear Train construction can be embodied in any 5/8, 3/4 or 1 inch Trident Meter—new or o d—at nominal cost. Any Water Department combatting conditions of corrosion, c ogging or extreme wear may adapt their present Tridents, in the specified sizes, to the new type simply by purchasing and installing the new type of gear train unit.

This means REAL INTERCHANGEABILITY—with every Trident Meter we have *ever made* in these sizes.

NEPTUNE METER COMPANY
50 East 42nd Street
NEW YORK CITY

2,000,000 TRIDENTS in Daily Use

WATER METERS

MADE WITH A SKILL AND PRECISION THAT ARE THE RESULT OF OVER HALF A CENTURY'S EXPERIENCE IN METER MANUFACTURING

Our six different types of meters meet successfully every service requirement. Their names; CROWN, NASH, EMPIRE, GEM, EMPIRE-COMPOUND and PREMIER are recognized everywhere as synonymous with accurate registration, economical operation, long life and general satisfaction.

NATIONAL METER COMPANY

Established 1870 **299 Broadway, New York**

SIMPLEX WIRES AND CABLES

— FOR —

STREETS AND PARKWAYS

Steel Taped Cables
For underground service without conduits. Easy to handle and inexpensive to install. It is flexible.

"Fibrex" Tree Wire
For overhead service among trees. Covered with a non-metallic, non-inductive armor that resists abrasion.

SIMPLEX WIRE & CABLE Co

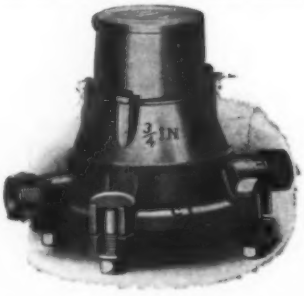
MANUFACTURERS
201 DEVONSHIRE ST. BOSTON
CHICAGO SAN FRANCISCO

VENTURI METERS

are recognized as standard equipment for gravity mains, filtration plants, pump discharge lines, sewage disposal systems, hydraulic turbines, etc., by the most prominent municipalities.

Builders Iron Foundry
"Builders of the Venturi for 29 years"
Providence, R. I.

Type M Register



Badger Water Meters Help to Stop Waste

Badger Water Meters guard the water supply against wilful waste, also make an appreciable cut in your coal bill.

Send us your address for information on how water meters can reduce overhead expenses.

BADGER METER MFG. COMPANY
841-847 30th Street Milwaukee, Wis.

ARCTIC WATER METER

In no other meter can you find the Arctic characteristics—Dependable and Accurate registration, the breakable Frost Bottom which minimizes the possibility of damage by freezing and the unit assembly of measuring mechanism which makes low maintenance.

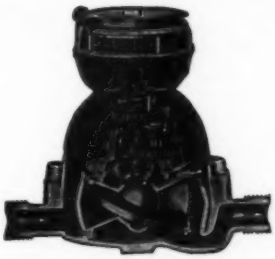
Send for Bulletin 59

Pittsburgh Meter Company

GENERAL OFFICE AND WORKS
EAST PITTSBURGH, PA.

New York—149 Broadway
Chicago—8 So. Wabash Ave.
Kansas City—6 W. 10th St.
Seattle—802 Madison St.
Columbia, S. C.—1433 Main St.
Los Angeles—Union Oil Building

Meters for measuring Water, Oil, Gasoline, Natural and Artificial Gas, Air, Oxygen and all other Gases and Liquids, either hot or cold, at any pressure.



Union Water Meter produced to meet the demands of all water department service.

Write for printed matter

Union Water Meter Co.
Worcester, Mass.

ELRECO COMBINATION RAILWAY and LIGHTING POLES

Make Lamp Standards unnecessary, one pole at half the cost does double duty—supports the trolley span wires, also ornamental bracket and handsome Lighting Fixture.

Full details in Catalog F—sent on request.

Electric Railway Equipment Co.
Cincinnati, Ohio
New York Office, 30 Church St.

A PITOMETER SURVEY :: ::

Will positively unearth all sources of water waste including underground leaks which cannot be seen on the surface. Let us prove it to you by demonstration in a "Test District."

Send us your address for further information.

The Pitometer Co.
Hudson Terminal Bldg., New York

UNION METAL LAMP STANDARDS

Union Metal and General Electric engineers will point out for you the "Right way for your White Way," whether your requirements be a large spectacular business district standard or a small, modest type for parkway or private grounds.

Send for complete catalog

The Union Metal Manufacturing Co.
CANTON OHIO

UNION METAL LAMP STANDARDS

OVER HALF A CENTURY IN CHICAGO

THE EDGAR A. ROSSITER CO.

CONSULTING ENGINEERS

127 N. Dearborn St., Chicago

Water supply, sewerage, and sewage disposal, drainage, farm and levee-pumping plants. electric light systems, pavements, track elevation, tunnels, mining

ODORLESS **DUSTOLINE FOR ROADS** STAINLESS

TRACKLESS (TRADE MARK) TRANSPARENT

THE DUSTOLINE FOR ROADS COMPANY

Summit, N. J., Phone 33

Has none of the objectionable features of the black asphaltic oils or tar preparations

ELECTRICAL PRODUCTS

To develop machinery for the generation, transmission, distribution and utilization of electricity in the form of light, heat and power, has been the aim of the General Electric Company for more than a quarter century.

G-E engineers in sales offices in all large cities are ready to assist in any problem where electricity may be used.

General Electric

General Office Schenectady, N.Y. Company Sales Offices in all large cities

King Street Lighting Standards

Write for illustrated matter

MADE BY

KING MANUFACTURING COMPANY

53 W. Jackson Boulevard

CHICAGO, ILL.

LAMBERT
WATER METERS

Made in all sizes, 5/8" to 6", of best Bronze Composition Thruout, fitted with unbreakable reinforced disc-pistons.

Write for booklet

THOMSON METER CO.
100-110 Bridge Street
Brooklyn, N. Y.

METERS

FOR OIL, GASOLINE WATER, ETC.

25 YRS. ON THE MARKET
400,000 SOLD

BUFFALO METER CO.

2898 Main St. Buffalo, N. Y.

DIRECTORY of ENGINEERS, CONTRACTORS, ARCHITECTS, ETC.

INTELLIGENT PLANNING — PROPER CONSTRUCTION

E. T. ARCHER & CO.
Consulting Engineers
Steam & Hydraulic Power Plants, Water, Sewerage, Paving, Roads, Appraisals, Testimony, Reports.
609-10-11-12 New England Bldg., Kansas City, Missouri

GULICK-HENDERSON CO.
Inspecting Engineers and Chemists
145 West 30th St., New York, N. Y.
INSPECTION AND TESTS OF
Structura Steel — Road Materia'
Cement — Creosoted Wood Blocks
Pipe — Railway Equipment
Pittsburgh—Chicago—Philadelphi

PEASE LABORATORIES, Inc.
Successors to
LEDERLE LABORATORIES
Sanitary, Bacteriological and Chemical Investigations for the Community or Individual.
39 W. 38th St., N. Y. City.

BANKS & CRAIG
134 East 44th St., New York City
709 Telegraph Building Harrisburg, Pa.
Municipal, hydraulic and sanitary engineers.
Design, operation, valuation.

New York City — 2 Rector Street
A. E. HANSEN
Hydraulic & Sanitary Engineer
Design & Supervision of Construction
Sewerage — Water Works
Sewage Disposal — Water Purification
Drainage — Water Works Valuation
Garbage Disposal — Water Analyses

CLARENCE D. POLLOCK
Member Am. Soc. C. E.
Consulting Engineer,
Pavements, Highways, Drainage, Sewerage, Town Planning and General Municipal Problems.
Reports, Specifications, Supervision.
Park Row Building, New York City.

Fuller & McClintock
CONSULTING HYDRAULIC ENGINEERS and SANITARY EXPERTS
170 Broadway, New York City
George W. Fuller — James R. McClintock — Jesse K. Gissey

J. WALLACE HIGGINS
Assoc. M. Am. Soc. C. E.
Civil and Landscape Engineer
Municipal Engineering, Sewerage, Parks, Cemeteries, Subdivisions, Topographic Surveys, Title Surveys, Estimates, Supervision.
82 Vanderbilt Avenue, NEW YORK

Robinson, Geo. L.,
Consulting Engineer.
Sewers, Sewage Disposal, Water Supply.
New York 37-39 East 28th Street

Gannett, Seelye & Fleming, Inc.
ENGINEERS
Reports — Valuations — Design — Management — Construction
Utilities — Industrials — Municipalities.
Harrisburg, Pa. — Erie, Pa.
Memphis, Tenn.

Nicholas S. Hill, Jr. — S. F. Ferguson
HILL & FERGUSON
Consulting Engineers
WATER SUPPLY—SEWAGE DISPOSAL—HYDRAULIC DEVELOPMENTS.
Reports, Investigations, Valuations, Rates, Design, Construction, Operation, Management. Chemical and Biological Laboratories
112 E. 19th St., New York City

C. E. SMITH & CO., Consulting Engineers
2065-75 Railway Exch. Bldg., St. Louis
1313 Steger Bldg., Chicago
204 Live Stock Exchange, Kansas City
Investigation, reports, appraisals, expert testimony, bridge and structural work, railway problems, electrification, grade crossing elimination, foundations, highways, docks, water supply, river and flood protection, drainage and sanitation, power plants.

FREDERICK GLAESER
CIVIL ENGINEER
Assoc. Member A. S. C. E.
Surveys — Inspection — Reports — Quantity Surveys—Contractors' Estimates—Materials listed from plans.
Bids Prepared — Rates Moderate
Contracts for Line & Grade Work.
660 Rutherford Ave., Trenton, N. J.

McClure Greene Engineering Co.
Civil and Consulting Engineers
Water Works, Sewers, Sewage Disposal, Streets, Pavements, Bridges, Dams, Concrete Structures, Hydraulic Developments. Investigations, Surveys, Designs, Specifications, Estimates, Reports, Construction Supervision and Management.
612-613 Park Building, Worcester, Mass.

Gilbert C. White, C. E.
M. Am. Soc. C.E.
M. Am. Soc. M.E.
CONSULTING ENGINEER
Durham, N. C.
An organization of Civil, Mechanical, Electrical and Chemical Engineers. Waterworks, Streets, Power Plants.

CONSULTING ENGINEERS
CIVIL
ELECTRICAL
MECHANICAL

GEORGE A. JOHNSON COMPANY
INCORPORATED
150 Nassau St., New York, N. Y.
Water Supply and Purification, Sewerage, Refuse Disposal, Power Development and Distribution, Industrial Plants and Public Utilities.

REPORTS, DESIGNS
VALUATIONS,
SUPERVISION OF
CONSTRUCTION
MANAGEMENT

UNIVERSAL AUDIT COMPANY
ACCOUNTANTS AND AUDITORS—INDUSTRIAL ENGINEERS
SINGER BUILDING (Cortlandt 6857) NEW YORK
SPECIALISTS IN ORGANIZATION AND MANAGEMENT PROBLEMS
PRODUCTION, COSTS, INDUSTRIAL RELATIONS

INDEX TO ADVERTISERS

After referring to the "Where to Purchase" Section, on pages 3 to 37, if you will look up the advertisements as per index below, you will be able to secure further data (with illustrations in many cases) on the material or equipment relative to which you are seeking information.

Acme Road Machy. Co. 79
Allis-Chalmers Mfg. Co. 89
Alpha Portland Cement Co. 85
American Well Works 89
Austin-Western Road Mach'y Co. 28

Badger Meter Mfg. Co. 94
Baker Mfg. Co. 18
Banks & Craig 97
Barber Asphalt Paving Co. 100
Barrett Company, The 80
Bay City Dredge Works 10
Best Tractor Co., C. L. 85
Briggs, Inc., Marvin 81
Bucyrus Co. 30
Buffalo Meter Co. 96
Buffalo-Springfield Roller Co. . . . 22
Builders Iron Foundry 94
Burch Plow Works Co. 8
Busch-Sulzer Bros.-Diesel Eng.Co 86

Carey Co., Philip 16
Central Foundry Co. 91
Cleveland Tractor Co. 32
Crane Co. 90
Craven Co., Frank T. 82
Cummings Machine Co. 8
Curtiss-Willis Co., The 82

De Laval Steam Turbine Co. . . . 89
Delaware Clay Products Co. 37
Dow Chemical Co. 80
Du Pont de Nemours & Co., E. I. . 80
Dustoline for Roads Co. 96

East Jersey Pipe Co. 88
Electric Railway Equipment Co. 95
Engineering News-Record 2
Equitable Asphalt Maint. Co. . . . 79

Fairbanks, Morse & Co. 88
Fairfield Engineering Co. 42
Federal Motor Truck Co. 84
Ford Meter Box Co. 92
Forsythe Bros. 82
Fuller & McClintock 97

Gannett, Seelye & Fleming 97
General Electric Co. 96
General Motors Truck Co. 99
Glaeser, Frederick 97
Good Roads Machinery Co. 20

Gray Iron Foundry Co. 6
Grey Steel Products Co. 81
Grinnell Co. 88
Gulick-Henderson Co. 97

Hansen, A. E. 97
Hauck Mfg. Co. 6
Heil Co., The 18
Heltzel Steel Form & Iron Co. . . . 79
Hersey Manufacturing Co. 92
Higgins, J. Wallace 97
Hill & Ferguson 97
Hollow Building Tile Assn. 84
Holt Manufacturing Co. 84

Indiana Air Pump Co. 92
International Motor Co. 85

Jaeger Machine Co. 79
Johnson Co., Inc., Geo. A. 97

Kelly-Springfield Tire Co. 85
King Mfg. Co. 96
King, Philip T. 82
Kinney Mfg. Co. 26
Knickerbocker Co., The 36
Koehring Co. 38-39
Koppel Indus. Car & Equip. Co. 8

Lea-Courtenay Co. 92
Littleford Bros. 84
Lynchburg Foundry Co. 86

Marion Steam Shovel Co. 30
Mathieson Alkali Wks., Inc., The 36
McClure Green Engr. Co. 97
McGraw-Hill Co. 2
McKiernan-Terry Drill Co. 12
Midwest Engine Co. 36
Mueller Mfg. Co., H. 90
Municipal Supply Co. 83

National Hoisting Engine Co. . . . 18
National Meter Co. 94
National Steel Fabric Co. 36
Nat'l Water Main Cleaning Co. 87
Neptune Meter Co. 93
Newport Culvert Co. 4
Nordberg Manufacturing Co. . . . 89
Northern Fire Apparatus Co. . . . 92
Norwood Engineering Co. 86
Novo Engine Co. 10

Otterson Auto Educator Co. . . . 88
Owen Bucket Co. 6

Pacific Flush-Tank Co. 88
Packard Motor Car Co. 83
Pawling & Harnischfeger Co. . . . 14
Payne Dean Limited 90
Peare Laboratories, Inc. 97
Pennsylvania Salt Mfg. Co. 86
Pioneer Asphalt Co. 22
Pitometer Co. 95
Pittsburgh-Des Moines Steel Co. 90
Pittsburgh Filter & Eng. Co. . . . 92
Pittsburgh Meter Co. 94
Porter Co., H. K. 8

Ransome Concrete Machy. Co. . 40
Robinson, Geo. L. 97
Rochester Can Co. 86
Rossiter Co., Edgar A. 96

Simplex Valve & Meter Co. 92
Simplex Wire & Cable Co. 94
Smith Mfg. Co., A. P. 90
Standard Oil Co. of Indiana. 75
Standard Scale & Supply Co. . . . 37

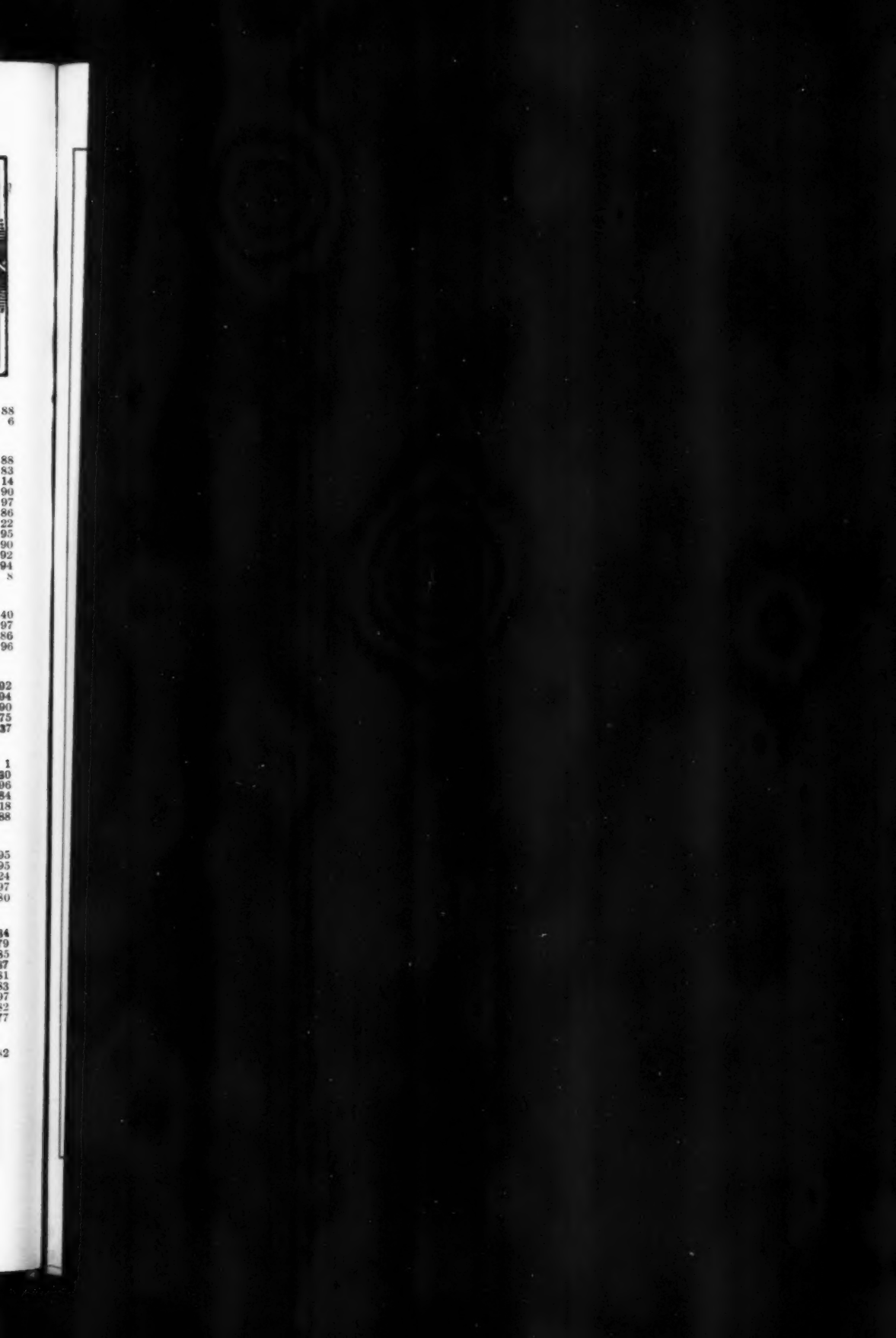
Texas Company, The 1
Thew Shovel Co. 30
Thomson Meter Co. 96
Tiffin Wagon Co. 84
Truscon Steel Co. 18
Turbine Sewer Mch. Co. 88

Union Metal Mfg. Co. 95
Union Water Meter Co. 95
U. S. Cast Iron Pipe & Fdy. Co. . 24
Universal Audit Co. 97
Universal Road Machinery Co. . 80

Wallace & Tiernan Co., Inc. 34
Waring-Underwood Co. 79
Warren Bros. Co. 85
Western Wood Pipe Pub. Bureau. . 87
Weiss, B. M. 81
White Co., The 83
White, Gilbert C. 97
White, J. P. 82
Winther Motor Truck Co. 77

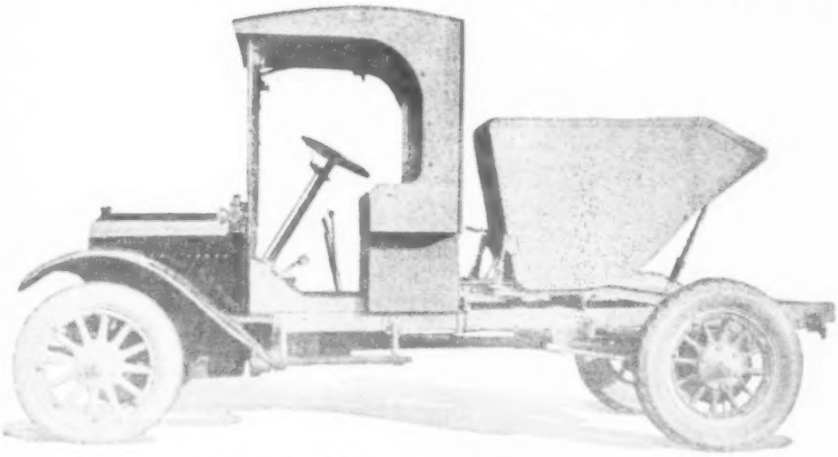
Zeigler & Bros., Max 82

Manufacturers who advertise in alternate issues may not appear in the above INDEX, but are carried in bold face type in the WHERE TO PURCHASE section at the front of this magazine. Readers wishing catalogs or further information regarding the products of these manufacturers should write to the CATALOG DEPARTMENT, CONTRACTORS' & ENGINEERS' MONTHLY, TRIBUNE BUILDING, NEW YORK CITY.



GMC

General Motors Trucks



GMC Road Builder

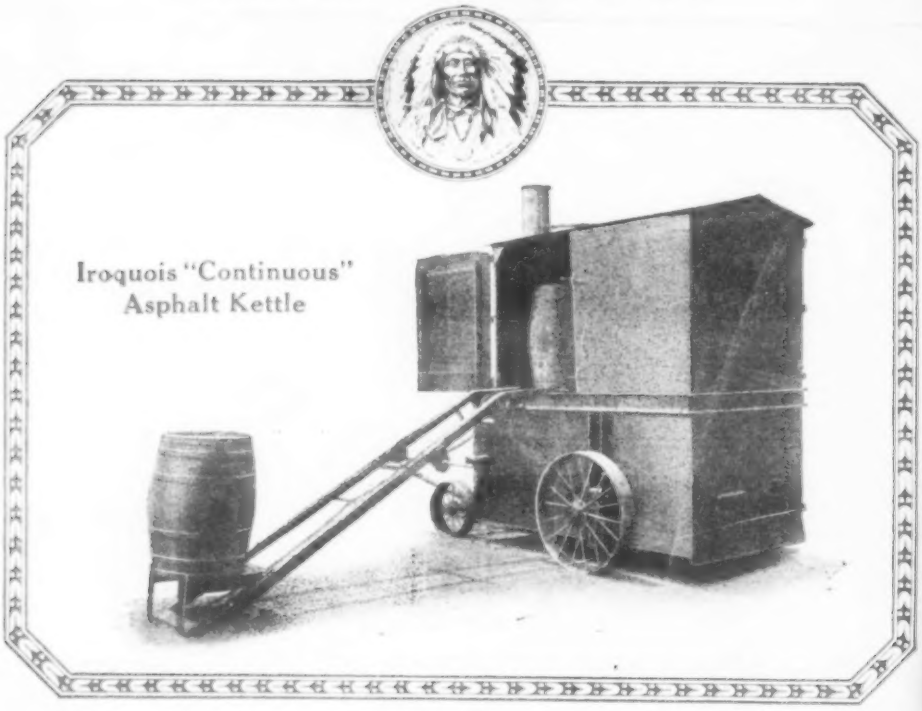
The GMC Road Builder is a specially equipped motor truck with capacity of one yard of concrete or other material. Body so arranged that load is well balanced on both axles. The special equipment can be removed easily, leaving a regular chassis on which a standard body can be used—making it an all-year utility—This is chassis standardized by U. S. Army and of which thousands were used overseas. Ask any soldier who was in France how they stand the abuse.

Ask us for special circulars on this Road Builder—
We make trucks in all capacities from ¾ to 5-ton.

GENERAL MOTORS TRUCK CO

Pontiac, Michigan

Branches and Distributors in principal cities



Designed and Built for Contractors who put value above first cost

Iroquois "Continuous" Asphalt Kettles, like all Iroquois equipment, are ***designed*** to save time and labor and ***built*** to withstand long and severe service. First cost comes last.

Iroquois "Continuous" Asphalt Kettles speed up work. There is no waiting for material—no delay. Charging with cold material and drawing off of hot material is a continuous operation.

Iroquois Portable and Stationary Rectangular Kettles are adapted especially for meeting the peculiar needs of asphalt road, street and roofing contractors. They are made in two sizes—6-barrel and 8-barrel capacities.

The Iroquois Line includes all tools needed by asphalt paving contractors—tampers, rakes, smoothers, cutters, shovels, hoes, scrapers, wire and rattan push brooms, etc.

Write for Bulletins Nos. 8, 6 and 5.

Trade Mark
Reg. U. S. Pat. Off.

The Barber Asphalt Paving Company

Iroquois Sales Department

New York Chicago PHILADELPHIA Kansas City Atlanta
Pittsburgh St. Louis